JOURNAL

OF THE

ASIATIC SOCIETY.

*Notes on the Bendkar, a people of Keonjur.* *By* Lieut. S. R. Tickell, *Political Assistant, S. W. Frontier.*

In the course of my last annual tour through the Kolehan district, (January and February 1842,) I came upon a set of people, whose names and history we have hitherto been quite ignorant of, (even within the Agency,) and whose existence I only then for the first time ascertained. They comprise one insulated clan or tribe, not above 250 or 300 in number, and call themselves "Bendkars." Their habits and manners, in restricting themselves entirely to hills, assimilate them to the Kurrials, a people well known in the mountainous districts, east and west of the Kolehan, and to be met with also in Birbhoom; but they deny any affinity to, or even knowledge of, the latter.

The Bendkars inhabit a small range of hills, called Bendkar Booroo, in the north of Keonjur, and close to Jamdapeer, (the southern border of the Kolehan.) The country is exceedingly wild, being in fact one uninterrupted sea of jungle, bounded to the N. and N. E. by the cultivated lands and villages of the Hos in Kotegurh and Burpeer, but whose limits in other directions have not been, nor probably ever will be, defined. These people have no separate language, but converse either in the Ho or the Ooria dialect, as occasion offers. In appearance they are much the same as the Bhooians of that part of the country, tolerably fair, well-made, and not devoid of intelligence; although from the excessive seclusion of their lives, they may be pronounced purely savage. By sending one of my chuprassees, with money and fair speeches, I was able to induce five or six of them to come into my camp in Sarndapeer. They were minutely questioned respecting their manners, customs, &c. but these appear to offer nothing particularly worthy of notice, being similar to those of other Semi-Hindoo tribes, such as the Bhoomijes, Bhooians, Sontals, &c. They worship *Kalee* and several tutelar *Deotas;* eat neither beef nor pork, drink water from a Ho's hand; but will not eat with them, nor would they touch food cooked by any Hindoo, even a Bramin. They have neither cattle, goats, sheep, nor pigs; but some keep a few head of poultry. Their houses are mere hovels formed of branches, leaves, and thatched with jungle grass, these are not built together, so as to form a village, but are scattered by ones

and twos about the base of the hill. Except on some few festive occasions, such as marriages, their manners are solitary and unsociable, and the poverty and misery of their mode of living almost surpasses belief, it being a common custom for a family to leave their hut in the morning, and pick up their entire subsistence for the day by grubbing in the jungle for roots, berries, hay, leaves of some species of trees; and then return as night falls, like mere wild beasts to their dwellings. When their scanty crops of maize, goradhan, (coarse rice) chunna, (gram), &c. are ripe, they fare somewhat better, and are occasionally able to bring some of the produce of their fields down to the nearest villages to barter for cloth. Their mode of cultivation is miserable; they earth up the furrows and water courses on the hill sides, and thus form small straggling *khets* or fields, which are liable occasionally to be washed bodily away, and should the crop attain maturity, the poor Bendkar is obliged to share it liberally with the wild pigs, deer, pea-fowl, and a host of such marauders, who help themselves at night to it, with impunity.

These people are not required to pay rent in money or in kind; but at the requisition of the nearest Sirdar, the Keonjur Raja's Dewan at Kalkapershaud, they are liable to be called upon as *bégars*, or coolies, to assist in conveying the baggage of the Raja, or of any of his household in their annual visits to Juggernauth. These, a very few, are acquainted with the use of money, but the majority neither know nor value it.

The party with me consisted of three men, an old woman, a girl, and a boy; the two latter were pretty. They had never seen a "white face," nor indeed even a respectable or well-dressed native. They had never even heard the word "*Saheb*," nor knew its meaning. Every thing of course was therefore a novelty and a source of amazement; the tents, horses, elephants, the sepoys and suwars with me, all attracted eager attention, not a little mixed with alarm. Only one of them had ever seen a gun fired off, and the grand exhibition of a bird shot while flying past, afforded great astonishment and delight. With all this ignorance, these poor people were pleasing in appearance, clean in person, and decorous in manner. They looked on quietly and demurely at every thing, and after a visit of two days, rather joyfully took their departure, not being, I suspect, quite satisfied of their safety while in my camp, although much re-assured by dint of gentle usage and kindness. The suwars with their bushy beards and long scarlet coats, appeared to afford them much uneasiness, and must have enforced on their minds greater awe and reverence than my less imposing costume!

They burn their dead, but do not collect the ashes, nor destroy any of the deceased's property with his body, (as the Koles do.) Their marriages are simple, being merely the bridegroom taking away his bride to his house, when the parents of both sides have consented, and have both added their quota to the stock supplied for the maintenance of the couple. No crimes (at least public crimes) appear to be known among this people, and they have no chief, or person possessing any kind of authority, to punish such. The smallness of their numbers, and

their confined locality is not satisfactorily accounted for, as they affirm they have been living on that hill alone for many generations. Nor to their knowledge, have their numbers been ever devastated by epidemic diseases. They are a perfectly peaceable race, never having been at issue with either Hos or Hindoos. They have arms, however, similar to those generally used in the country, which they employ in the chase.

The only specimen of their handicraft, which I procured from them, and which I beg, through you, to present to the Society, is the accompanying *plough*. It is used by the hand, as they have no cattle ; and is capable, as may be seen, of merely scratching up the surface of the soil. It is not handled in the manner of a hoe, or *fowra*, but dragged or scraped along, as far as the sweep of the arm allows : and it will be admitted, I think, that for barbarity, the instrument is unique.

---

Note.—The implement alluded to, is now in the Museum of the Asiatic Society. It is a rough hewn stick, nearly four feet long, which has been separated from the tree just below the off-shoot of a branch, at rather an acute angle with it, the off-shoot being cut down to about 10 inches long, and sharpened at the point, so as to take the ground like a rude pick axe : this is made more effective by an iron spike or peg, driven through the stick an inch or so above the off-shoot, and made to correspond in length with it. The cultivator using it, would, by dragging the implement towards him, have the soil, divided by the iron peg, and the furrow formed by the thicker substance of the off-shoot behind it.

---

*Captain* Shortreede, *in continuation of his Paper, p.* 28, *in No.* 121 *of this Journal.*

1. In continuation of our researches regarding the spherical excess in terms of the two sides and the contained angle, we resume the expression formely given $\tan \frac{1}{2} E = \frac{\tan \frac{1}{2} a \tan \frac{1}{2} b \sin C}{1 + \tan \frac{1}{2} a \tan \frac{1}{2} b \cos C}$ which may be otherwise written $\tan \frac{1}{2} E = \tan \frac{1}{2} a \tan \frac{1}{2} b \sin C \left( \frac{1}{1 + \tan \frac{1}{2} a \tan \frac{1}{2} b \cos C} \right)$; and the denominator within the parentheses may be expanded in the usual way.

2. For $\tan \frac{1}{2} a$ and $\tan \frac{1}{2} b$ substitute their values in arc to radius 1 by the formula $\tan \chi = \chi + \frac{1}{3} \chi^3 + \frac{2}{15} \chi^5 + \frac{17}{315} \chi^7 +$ &c. and we have $\tan \frac{1}{2} a \tan \frac{1}{2} b = \left( \frac{a}{2} + \frac{a^3}{24} + \frac{a^5}{240} + \frac{17\, a^7}{39720} + \text{&c.} \right) \left( \frac{b}{2} + \frac{b^3}{24} + \frac{b^5}{240} + \frac{17\, b^7}{39720} + \text{&c.} \right)$ and by actual multiplication we get $\tan \frac{a}{2} \tan \frac{b}{2} = \frac{ab}{4} \left\{ 1 + \frac{a^2 + b^2}{12} + \frac{6\, a^4 + 5\, a^2 b^2 + 6\, b^4}{720} + \frac{136\, a^6 + 63\, a^4 b^2 + 63\, a^2 b^4 + 136\, b^6}{40320} + \text{&c.} \right\}$ this expression and its powers being substituted in the expansion

of the original equation, becomes, $\tan\frac{E}{2} = \frac{ab}{4}\sin C \left\{1 + \frac{a^2+b^2}{12} + \frac{6a^4+5a^2b^2+6b^4}{720} + \&c.\right\} \left\{1 - \frac{ab}{4}\cos C \left(1 + \frac{a^2+b^2}{12} + \&c.\right) + \frac{a^2b^2}{16}\cos^2 C\left(1 + \frac{a^2+b^2}{6} + \&c.\right) - \frac{a^3b^3}{64}\cos^3 C\left(1 + \&c.\right) + \&c.\right\}$ by actual multiplication and reduction of terms with common factors, this becomes

$$\tan\frac{E}{2} = \frac{ab}{4}\sin C\left\{1 + \frac{a^2+b^2}{12} - \frac{ab}{4}\cos C + \frac{6a^4+5a^2b^2+b^4}{720} - \frac{a^3b+ab^3}{24}\cos C + \frac{a^2b^2}{16}\cos^2 C + \&c.\right\}$$

3. For $\tan\frac{E}{2}$ substitute its value in arc $\frac{E}{2} + \frac{E^3}{24} + \&c.$ and transpose $\frac{E^3}{24} + \&c.$, and substituting for them their values in powers of the right hand quantity, $\frac{E^3}{24} = \frac{1}{3}\left(\frac{ab}{4}\right)^3\sin^3 C + \&c. = \frac{ab}{4}\sin C \left(\frac{a^2b^2}{48} - \frac{a^2b^2}{48}\cos^2 C + \&c.\right)$ then incorporating this and multiplying the whole by 2, we have

$$E = \frac{ab}{2}\sin C\left\{1 + \frac{a^2+b^2}{12} - \frac{ab}{4}\cos C + \frac{3a^4-5a^2b^2+3b^4}{360} - \frac{a^3b+ab^3}{24}\cos C + \frac{a^2b^2}{12}\cos^2 C + \&c.\right\}$$

4. The first term is the same as that for the area of a plane triangle having the same sides and contained angle: the following terms therefore shew the difference between the arcas of the two triangles. Of these terms we may take account of as many as suits our object; but in ordinary cases it will be needless to regard any beyond the two first. Limiting ourselves to these, the difference between the areas of the plane and spherical triangles corresponds to an excess represented by $\frac{ab}{2}\sin C\left(\frac{a^2+b^2}{12} - \frac{ab}{4}\cos C\right)$ or by $\frac{ab}{24}\sin C\left\{a^2 + b^2 - 3ab\cos C.\right\}$

5. This expression shews that when C exceeds a right angle (cos C becoming — ) the spherical area must exceed that of the plane triangle. When the two terms within the brackets cancel each other, the two triangles have equal areas; and when the second term exceeds the first, the spherical area will be less than that of the plane triangle.

6. The limits are easily assigned.

7. The sum of $a$ and $b$ being given, $a^2 + b^2$ is a minimum, and $ab$ or $3ab$ is a maximum when $a = b$. In this case the triangles are isosceles, and $a^2 + b^2 = 2a^2$, and $3ab = 3a^2$; hence the terms within the brackets will cancel each other when $\cos C = \frac{2}{3}$, or when $C = 48° 11' 23''$. This for equal arcas is the maximum of C. With isosceles triangles, if C be less than this, the spherical area will be less than that of the plane triangle.

8. Again when cos C is a maximum, C = 0: In this case, $a^2 + b^2 = 3\,a\,b$ or $1 + \frac{b^2}{a^2} = 3\frac{b}{a}$; the solution of a quadratic will give $\frac{b}{a} = \frac{3+\sqrt{5}}{2} =$ 2·618 nearly. This is the maximum inequality in the sides so as to have equal areas.

9. In like manner may be found the value of the angle for any given ratio of the sides within these limits; or the angle being given, the ratio of the sides may be found.

10. The following Table shews for given ratios of $a$ and $b$ the value of C giving equal areas:—

| $\frac{b}{a}$ | Cos C | Log. cos C | C |
|---|---|---|---|
| 1·0 | $\frac{200}{500}$ | 9·82391 | 48.°11′ |
| 1·1 | $\frac{221}{550}$ | ·82588 | 47·57 |
| 1·2 | $\frac{244}{360}$ | ·83109 | 47·20 |
| 1·3 | $\frac{269}{390}$ | ·83869 | 46·23 |
| 1·4 | $\frac{296}{420}$ | ·84804 | 45·11 |
| 1·5 | $\frac{325}{450}$ | ·85867 | 43·46 |
| 1·6 | $\frac{356}{480}$ | ·87021 | 42·08 |
| 1·7 | $\frac{389}{510}$ | .88238 | 40·18 |
| 1·8 | $\frac{424}{540}$ | ·89498 | 38·16 |
| 1·9 | $\frac{461}{570}$ | ·90783 | 36·01 |
| 2·0 | $\frac{500}{600}$ | ·92082 | 33·33 |
| 2·1 | $\frac{541}{630}$ | ·93386 | 30·50 |
| 2·2 | $\frac{584}{660}$ | ·94687 | 27·46 |
| 2·3 | $\frac{629}{690}$ | ·95980 | 24·16 |
| 2·4 | $\frac{676}{720}$ | ·97262 | 20·08 |
| 2·5 | $\frac{725}{750}$ | ·98528 | 14·50 |
| 2·6 | $\frac{776}{780}$ | ·99777 | 5·48 |

11. If the sides were so large in regard to the radius, as that the terms omitted could sensibly affect these results, it would be necessary to take those of the next, and perhaps also of higher orders.

12. To ascertain the actual difference in the areas of the spherical and plane triangles in an extreme case, suppose an equilateral with sides of 1½ degrees: the direct formula gives the excess = 61.217; and the difference in the areas of the two triangles will be ·3951 square miles, corresponding to an excess of 0·″005245. One-third of this would be the difference on each angle, and were it ten times as great, it would still be, in Troughton's phrase, a quantity less than what is visible in the teleseope.

13. It is almost needless to remark, that the supposed triangle is larger than any which has yet occurred in practice. The great triangle in the French arc, long supposed to be the largest in the world, has an excess of about 39″. I have had one observed by day-light on which the excess was about 41″.5. This least side was 80 miles, and the largest 92·6. Such a triangle does not often occur, but even this has only about $\frac{2}{3}$ of the area of that on which the difference has been shewn to be utterly invisible.

14. But as the greatest difference occurs when C exceeds a right angle, we may find the partieular angle giving the maximum difference by making $\frac{a\,b}{24}\left\{\left(a^2 + b^2\right)\sin C - 3\,a\,b\sin C\cos C\right\}$ a maximum: by differentiating, we have $\frac{a\,b}{24}\left\{\left(a^2 + b\right)\cos C - 3\,a\,b\cos 2\,C\right\} d\,C = o$:

$\therefore$ the maximum corresponds to $\frac{a^2 + b^2}{3\,a\,b} = \frac{\cos 2\,C}{\cos C}$. This is an equation which scarcely admits of a direct solution, but the indirect solution is very easy.

15. As C is to be greater than a right angle, we may put $90 + \chi = C$

$\therefore \frac{\cos 2\,C}{\cos C} = \frac{\cos 2\,\chi}{\sin \chi}$. As $\frac{a^2 + b^2}{3\,a\,b}$ is always +, it is plain that $\chi$ cannot exceed 45°, nor be less than 0. Hence the quantity $\frac{\cos 2\,\chi}{\sin \chi}$ will pass through all its values from 0 to $\infty$ every half quadrant. By tabulating this, as under, for every degree of $\chi$, we shall have by inspection for any ratio of the sides, the approximate angle giving a maximum difference of arcas. A nearer approximation may be got by making proportion for the differences between the tabular and actual quantities in the usual way; and by computing another value on each side of the angle so found, we may by successive steps bring the approximation as close as we please.

| C | Log. $\frac{\cos 2\,C}{\cos C}$ | C | Log. $\frac{\cos 2\,C}{\cos C}$ | C | Log. $\frac{\cos 2\,C}{\cos C}$ |
|---|---|---|---|---|---|
| 91 | 1·75788 | 106 | 0·48808 | 121 | 9·95977 |
| 92 | ·45612 | 107 | ·45264 | 122 | ·91763 |
| 93 | ·27881 | 108 | ·41798 | 123 | ·87320 |
| 94 | ·15217 | 109 | ·38389 | 124 | ·82601 |
| 95 | ·05306 | 110 | ·35020 | 125 | ·77546 |
| 96 | 0·97117 | 111 | 0·31674 | 126 | 9·72076 |
| 97 | ·90101 | 112 | ·28336 | 127 | ·66088 |
| 98 | ·83929 | 113 | ·24989 | 128 | ·59433 |
| 99 | ·78387 | 114 | ·21620 | 129 | ·51901 |
| 100 | ·73332 | 115 | ·18212 | 130 | ·43160 |
| 101 | 0·68657 | 116 | 0·14750 | 131 | 9·32661 |
| 102 | ·64285 | 117 | ·11217 | 132 | ·19372 |
| 103 | ·60157 | 118 | ·07595 | 133 | 8·00980 |
| 104 | ·56226 | 119 | ·03864 | 134 | 7·70105 |
| 105 | ·52453 | 120 | ·00000 | 135 | $-\infty$ |

16. By means of this and the former Table, it appears that with equal sides the angle of maximum difference of areas is somewhat greater than 124°, and by another computation it will be found that the exact value is 124°·02′·35″ being the greatest angle giving a maximum difference of areas. For any other ratio of sides the angle will be smaller. For the ratio $\frac{3 + \sqrt{5}}{2}$ the angle is 120°. When the ratio is $\frac{10}{1}$, the value of $\frac{a^2 + b^2}{3\,a\,b}$ is $\frac{101}{30}$ and Log. $\frac{\text{Cos } 2\,C}{\text{Cos } C}$ is 0·52720, which corresponds to an angle of about 4′·25 less than 105, or 104°·55′·75; and so in other cases. When the ratio of the sides becomes indefinitely great, the maximum difference angle approaches indefinitely near 90.

17. In well chosen triangles, there are not usually any very great differences in the sides, and hence practically the greatest differences will usually occur when C is not far from 120°.

18. If for example we suppose a triangle with sides of a degree each, and containing an angle of 120°, by the original formula the excess is 27″·210 and the difference in area between the spherical and plane triangles is 0·18214 square miles, corresponding to an excess of 0″·0024176. On a triangle with degree sides and the maximum angle of 124°·02′·35″ the excess is 26″·035 the differences of areas 0·18320 square miles, corresponding to an excess of 0″·0021318. Such differences though utterly in-

visible in the telescope, are still much greater than have ever occurred in practice; for though single sides of more than a degree be nothing very extraordinary, it is but rarely that two such sides can be found forming a triangle with a third side of from 118 to 120 miles.

19. The difference here treated of is, in similar triangles, proportional to the 4th powers of the homologous sides: Hence, in an equilateral with half degree sides, this difference would be $\frac{1}{81}$ of 0″·005245, or 0″·00006475; and on the isosceles with half degree sides containing 120°, the difference would be $\frac{1}{16}$ of 0″·0024176, or 0″·00001511. Triangles such as these are not very uncommon, but it is much more common to have triangles with less than half of their area.

20. It is thus fairly proved that the difference between the excess on a spherical triangle computed rigidly, and that deduced by reckoning its area as equal to that of a plane triangle of the same sides and contained angle, is a quantity so small that, even in extreme cases, the neglect of it will induce no sensible error; and that in triangles such as usually occur in practice, the difference is so utterly insignificant, that to go much out of the usual way in order to take account of it, would be a very needless refinement.

---

## *Notes regarding the Meteorology and Climate of the Cape of Good Hope.*

*By* Robert Trotter, Esq. *Bengal Civil Service.*

When last at the Cape it occurred to me, that a few particulars regarding the climate of a place, to which so many resort from this country in search of health, might be found interesting as well as useful: and particularly to medical men, by enabling them to judge how far it is likely to prove beneficial to those patients, for whom they may consider an absence from India necessary. If you deem the accompanying Meteorological Table, and the following cursory remarks worthy of a place in your Journal, I shall feel obliged by your inserting them.

The table contains an abstract I prepared from the Meteorological Registers of the Royal Observatory at the Cape, shewing the mean monthly weight and temperature of the atmosphere, and the minimum of each month for three years together, with the monthly fall of rain for the same period; and in order to compare the results with the climate of India, I have inserted corresponding observations made at Calcutta for an equal period, and likewise the monthly means of a year's observations at several other stations; viz. Darjeeling, Dacca, and Cawnpore, extracted chiefly from the *Journal of the Asiatic Society*.

The Cape observations were made at 3 hrs. 15′ P. M., being the period of least atmospherical pressure; the Thermometers hang on the South-

east side of the building, in the shade, and protected from solar radiation; 4 P. M. is the hour of most of the Indian observations, a few only of those at Darjeeling having been made at 4 hrs. 30′ and 5 hrs. P. M.— the time of each set of observations therefore, being about an hour after the hottest period of the day, a rough estimate may be formed of the usual afternoon temperature, as well as a pretty fair comparison of the maximum temperature of the above places with that of the Cape, while from the means of the monthly minima, a comparison may be formed of the greatest average cold at the Cape and Darjeeling.

As Cape Town lies close to the base of Table Mountain, which, together with the Lion and the Devil's Peak encompasses it on three sides, its temperature is considerably higher than that of the Observatory, which is nearly three miles distant, and being situated on the low isthmus between False Bay and Table Bay, enjoys the benefit of the breeze which generally blows from one bay or the other.

The Camp ground, Rondebosch, and Wynberg, possess a similar advantage in point of situation over Cape Town, (from which they are distant from 4 to 8 miles.) They are the favourite abode of Indian visitors during the warm months, but as they lie nearer than the Observatory to the mountain, the weather is much damper, and the fall of rain considerably greater during the winter, than at that place. In the hot weather, however, they certainly enjoy a cooler climate, in consequence probably of the greater abundance of verdure and shade.

Table Mountain, and indeed the whole range of hills, of which the Devil's Peak is the northern extremity, produce a variety of interesting atmospherical phenomena, and often times occasion an entire difference in the state of the weather at Cape Town, which is situated on the west side, and at Wynberg and Rondebosch on the other side of the range.

The north-west winds which prevail during the winter, are always loaded with much vapour, and bring much rain, but as the rain is frequently not formed till the vapour, after passing over Cape Town, has reached the cold summit of the mountain, it very often happens that though a fine day in Cape Town, it is raining heavily at Wynberg, Rondebosch, and other places on the lee side of the mountain. During the summer months, the same cause gives rise to a similar phenomenon, and occasions the well-known appearance on the top of the mountain, called the Table Cloth. The south-east sea breeze, which prevails at this

season, unlike our Indian scorching hot winds, is cool and refreshing even in the hottest weather, and not being so highly charged with humidity as the northerly winds, the vapour it contains frequently passes over the mountain without becoming visible. Oftener, however, it is changed into a mist or cloud, which covers the top of the mountain, and is seen on the lee, or Cape Town side, rolling down in large fleecy volumes, till it reaches a warmer temperature, when it again becomes invisible. The elevation of this vanishing point varies with the hygrometric state of the atmosphere, and the line, thus formed, is so distinct that were degrees to be marked on the perpendicular cliffs which over-hang Cape Town, a gigantic, but correct hygrometer would be furnished. I may here express my regret, that I possess no notes of the hygrometric condition of the atmosphere of the Cape, sufficiently accurate to be recorded.

The different eddies and counter-currents of air produced by the influence of the mountain, and by the interruption it occasions to the general current of air, are also interesting phenomena. Among others, a remarkable one is often experienced by ships entering the Bay with a fair wind. On reaching a certain point they are frequently taken a-back, and find themselves in a strong breeze blowing right out of the Bay; and few who have lived at the Cape can have failed to observe occasionally, a northerly and a southerly wind blowing at the same moment in different parts of the Bay, a line of confused ripple clearly marking the limits to which the adverse winds, extend; and I may add another curious appearance I have repeatedly observed at Wynberg in winter, when north-westerly winds are bringing large clouds over the mountains; viz. a circular spot of blue sky in the direction of Constantia, about 10° to 15° in diameter, and about 20° from the zenith, on reaching which the clouds become invisible, but after passing it, they resume their former appearance. It may probably be accounted for by their meeting at that point a current of rarefied air, which having found its way through a neighbouring gap in the range of mountains, has not been cooled by passing over their summit. Those acquainted with these localities well understand that the gap alluded to, is that through which the road to Hout's Bay passes.

I may conclude these remarks, with a memorandum of the mean temperature of Cape Town, and three other localities in the interior, extracted from a printed statement I fell in with at the Cape, but I can

neither attest its accuracy, nor explain how the means, there given, have been obtained.

" The mean temperature of Cape Town, inferred from a Meteorological Journal kept there for several years, is $67\frac{1}{3}°$—the mean temperature of the coldest month is perhaps 57°—hottest 79°—mean of three recent winters 58°—of three summer months 77°—least heat during summer 63°."

" The temperature of the district of Stellenbosch deduced from the observations of a single twelvemonth is $66\frac{1}{3}°$—extremes 87° and 50°. The temperature of Zwartland appears to be $66\frac{1}{3}°$—extremes 89° and 54°—the exposure of the thermometers is at neither place external; they are suspended in spacious well-aired halls."

" At Tulbagh, situated in a valley of the great chain of mountains which divides the western from the eastern provinces of the colony, the mean temperature of the year is $66\frac{2}{3}°$—that of the coldest month $55\frac{1}{2}°$—of the hottest $80\frac{1}{2}°$—extremes 94° and 92°—mean of the three winter months $56\frac{1}{2}°$, of three summer months 79°; least heat in summer 61°."

## CAPE OBSERVATORY.

*Mean of Observations made at* 3° 15′ P. M.

| | 1837-38. | | | | 1838-39. | | | | 1839-40. | | | | Average. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barm. | Ther | Min. | Rain Ins. | Barm. | Ther | Min. | Rain Ins. | Barm. | Ther | Min. | Rain Ins. | Ther. | Min. | Rain Inches. |
| July, | 30.257 | 62.3 | 39.8 | 1.16 | 30.163 | 57.5 | 38.3 | 3.48 | 30.310 | 59.9 | 30.5 | 1.77 | 59.9 | 36.3 | 2.14 |
| August, | .163 | 59.7 | 37. | 1.81 | .154 | 60.4 | 38.3 | 2.51 | .157 | 59.6 | 36.4 | 2.72 | 59.9 | 37.2 | 2.35 |
| September, | .418 | 60.3 | 39. | 2.41 | .141 | 61.2 | 37. | 1.50 | .196 | 62.7 | 43.7 | 0.49 | 64.7 | 39.9 | 1.47 |
| October, | .168 | 65.5 | 40.5 | 0.45 | .138 | 69.2 | 41. | 0.24 | .066 | 65.8 | 42. | 1.80 | 66.8 | 41.2 | 0.86 |
| November, | .081 | 59.3 | 48.4 | 1.24 | .038 | 70. | 50.3 | 2.39 | .051 | 70.3 | 47.7 | 0.12 | 66.5 | 52.1 | 1.25 |
| December, | .055 | 71.7 | 47.8 | 0.57 | 29.993 | 70.1 | 50.6 | 1.54 | .031 | 70.1 | 52.8 | 1.60 | 70.6 | 53.7 | 1.24 |
| January, | 29.996 | 74.3 | 52. | 0.0 | 30.057 | 73.7 | 52.5 | 0.12 | .061 | 74.3 | 46.8 | 0.51 | 74.1 | 50.4 | 0.21 |
| February, | 30.004 | 75.4 | 52.8 | 0.6 | .032 | 74.9 | 54.4 | 1.18 | .012 | 73.8 | 48.9 | 0.28 | 74.7 | 52.2 | 0.51 |
| March, | .071 | 72. | 52.8 | 0.16 | .099 | 71.8 | 49. | 2.32 | .050 | 74.1 | 47.8 | 0.00 | 72.6 | 49.9 | 0.83 |
| April, | .101 | 67.8 | 47.5 | 1.22 | .128 | 68.9 | 40.5 | 0.65 | .071 | 68. | 47.7 | 3.03 | 68.2 | 45.2 | 1.63 |
| May, | .173 | 61.8 | 44. | 4.33 | .161 | 62.4 | 35. | 2.19 | .114 | 63.8 | 39. | 1.68 | 62.7 | 39.3 | 2.73 |
| June, | .174 | 59.5 | 36.8 | 5.53 | .279 | 60.4 | 37.5 | 1.68 | .205 | 58.5 | 39.4 | 4.20 | 59.5 | 37.9 | 3.80 |
| Total fall of rain, .. | .. | .. | .. | 1948 | .. | .. | .. | 1980 | .. | .. | .. | 1820 | .. | .. | 1902 |
| Yearly average Temperature, .. | .. | 65.8 | .. | .. | .. | 66.7 | .. | .. | .. | 66.7 | .. | .. | 66.5 | 44.6 | .. |

| | CALCUTTA. *Mean of Observations at* 4° P. M. | | | | | | | 1837. *Darjeeling.* | | 1840-41. *Dacca.* | 1834-5. *Cawnpore.* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1836. | | 1837. | | 1838. | | Average. | Mean Temp. at 4 P. M. | Monthly Minimum | Mean Temp. at 4 P. M. | Mean Temp. at 4 P. M. |
| | Barm. | Ther. | Barm. | Ther. | Barm. | Ther. | Ther. | | | 1841. | 1835. |
| January, | 29.946 | 68.8 | 29.970 | 75.3 | 29.903 | 74.5 | 72.9 | 43.4 | 32.8 | 70.9 | 69.5 |
| February, | .874 | 74.3 | .919 | 81.9 | .872 | 82. | 79.4 | 45.5 | 34.2 | 58.8 | 74.7 |
| March, | .787 | 83.9 | .775 | 90.9 | .757 | 89.5 | 88.1 | 55.7 | 43.1 | 82. | 81.4 |
| April, | .620 | 90.9 | .639 | 94.4 | .621 | 93. | 92.8 | 60.2 | 48.1 | 89.1 | 92.1 |
| May, | .542 | 95.9 | .585 | 94.8 | .574 | 96. | 95.6 | 60. | 50. | 88. | 100. |
| June, | .460 | 90. | .502 | 94. | .133 | 89.7 | 91.2 | 64.5 | 55.8 | 86.5 | 93. |
| July, | .504 | 86.2 | .435 | 86.2 | .448 | 86.8 | 86.4 | 63.5 | 57.3 | 76. | 88.2 |
| August, | .472 | 87.5 | .508 | 85.7 | .487 | 86.4 | 86.5 | 63.5 | 57.4 | 85.9 | 90.3 |
| September, | .581 | 87.7 | .613 | 88.2 | .620 | 87.5 | 87.8 | 62.3 | 55.2 | 58.1 | 88.6 |
| | | | | | | | | | | | 1834. |
| October, | .815 | 86 3 | .753 | 86.5 | .793 | 86.4 | 86.4 | 60.5 | 49.5 | 82.8 | 80.7 |
| November, | .862 | 80.3 | .864 | 80.7 | .849 | 81.3 | 80.8 | 53.5 | 43.5 | 79.1 | 77.7 |
| | | | | | | | | | | 1840. | |
| December, | .989 | 75.1 | .933 | 75.3 | .893 | 78. | 76.1 | 47.6 | 39.9 | 70.4 | 71.0 |
| Yearly average Temperature, | .. | .. | .. | .. | .. | .. | 85.4 | 56.7 | 47.2 | 77.3 | 84. |

*Report upon the Manufacture of Steel in Southern India. By Captain* Campbell, *Assistant Surveyor General.*

The mode of making the Indian Cast Steel, or Wootz, is up to the present time a paradox with the learned of Europe.

Dr. Buchanan in his "Tour in Mysore," published the first account of the process, which he describes as fusing two pieces of iron in a crucible, two pieces of wood, and two green leaves.

In the 26th No. of the *Madras Journal of Science*, is given a reprint of a paper by Mr. Heath, with reference to a letter addressed by the Royal Society to the Right Honorable the Governor of Madras, in which he repeats Buchanan's statement, and speculates upon the theoretical action of the gases evolved from these two green leaves; but that he was unacquainted with the true principle of the process is made evident by his notice of Dr. Pearson's and Mr. Stoddart's opinions, that the steel is a natural product.

As supported by the opinions of good authorities upon the subject, it does not appear that any one has been sufficiently presumptuous to think of doubting the fact. This I, however, have taken the liberty to do, in some remarks published in the 6th No. of Dr. McClelland's *Calcutta Journal of Natural History.*

As it appeared to me that the native process of smelting iron was very rude and imperfect, and admitted of considerable improvement, without making such alterations as would be impracticable for the familiar use of the natives of India, I have had furnaces constructed, exact models of those in general use, and have had their process repeated, so that I might have opportunities of minutely examining every step of the process.

A result of my investigations, is, that the iron sand of India has the property, by a peculiar modification of the blast, and proportion of the fuel, of affording a natural steel of good quality as an immediate product of the ore, or what is technically called, a "natural steel," and on examining the common iron made by the natives from this ore, I find that it always contains $\frac{1}{4}$ of steel, and often one-half of its weight.

As the iron used at the localities mentioned by Buchanan is made, (to my knowledge,) from the iron sand, the above fact at once affords an explanation of the process so long paradoxical which is, that the

supposed iron put into the crucible with the pieces of wood, and two green leaves, was two pieces of natural steel, which I have found by experiment in my blast furnaces to melt very easily.

This natural steel has the property of welding, from which the natives call it iron, and it must have been thus that they misled Dr. Buchanan; while cast steel, the only one they are acquainted with, falls to pieces like sand upon being heated to a white heat.

From its property of welding, this natural steel is peculiarly valuable for making axes, bill-hooks, and tipping plough shares, and the cheap rate at which it can be made (about 2 annas for 6 pounds) is of considerable consequence to the poor and labouring class of natives, as the only steel now procurable in India is sold at the rate of $3\frac{1}{2}$ pounds for a rupee.

For coarse purposes, natural steel is imported largely into England from Germany, and Styria, and it is probable that from the cheap rate at which the above natural steel can be made in India, that it may prove to be a valuable article of export from South India to Europe; and as the granitic tract of the Barramahal affords inexhaustible quantities of the iron sand and fuel, there can be but little doubt of the possibility of the manufacture.

I have no intention of concealing the mode of producing the natural steel; but as my researches upon the subject are yet in a very crude state, and as much further investigation by chemical analysis is necessary into the composition of the iron sand, (which is a titaniferous mineral,) the various scorias of the furnace, and the compositions of the steel, and the theory of its formation, I shall reserve these particulars for a more complete report upon the subject.

*Royacottah, 5th October*, 1841.

---

*Report upon the Improvement of the Silk manufactured in Mysore and the Salem Districts. By Captain* J. Campbell, *Assistant Surveyor General.*

In the Salem district, silk is manufactured in small quantity, in Bairkay and Bangalore, and in a few small villages. In Trippatore it was formerly attempted to be introduced, but has failed for some reason not recorded.

In Mysore, silk is manufactured in much larger quantities, and it appears to be increasing very rapidly.

The manufacture is almost solely in the hands of the Mussulman population; and averse as the Mussulmans generally are to any field labour, or labour of any kind which requires much bodily exertion, the encouragement of this manufacture requiring but light labour, and only periodical attention, may prove valuable means of making productive a large proportion of the inhabitants of South India.

The quality of the silk as generally made is very bad, being simply reeled from the cocoons heated in a large earthen pot upon a large, rude reel, with four bars placed immediately over the vessel; and no attempt is made to remove the useless silk upon the surface of the cocoons, or to keep them clean from dust or dirt, nor to prevent the silk adhering by its gum upon the reel.

The value of the common silk various from two Rs. to three Rs. per seer of 24 Rs. weight, and it is principally consumed in the country at Wallujapet and Salem, where it is used in ornamenting the borders of cotton cloths, and for weaving into coarse silk cloths; and I believe that its quality is at present too bad to fetch any price whatever in the English market.

The demand for this inferior silk in the country must be limited; and it is probable that the only mode of increasing the manufacture is to increase the quality, so as to fit it for exportation to the London market.

It is well known that silk of good quality can be made in South India, from the fact of the manufacture being carried on at the present time by some European settlers.

The machinery used in Europe for reeling silk is beyond the means of the natives of India, who are generally very poor, but upon looking over the plan and drawings of these machines, it has occurred to me, that by a simple modification of the machine, I shall be able to construct them of cheap materials, upon a plan which may be probably made up by any one, even not a workman, for five rupees.

It is my intention to construct some reels upon this plan, and having proved their efficiency by experiment, to report again upon the subject, and to forward specimens of the silk manufactured with them.

The process of reeling silk is simple and easy, and the manipulation though delicate, is not difficult for any native to acquire; and there can

be no doubt that if a few models of the improved machines were distributed, and a small establishment set up where they could be seen in use by those who choose to attend to learn the process, that the necessary information would be rapidly disseminated; for the indigent Mussulmans, in whose hand the manufacture now is, are generally very apt and intelligent, and unlike the Hindoo population, are quite sensible of, and ready to appreciate and make use of, the advantages of any improvement.

The principal difficulty in the improvement of the manufacture was suggested to me by one of these persons now employed in it, which is the difficulty of finding a market for the improved article at a remunerating price.

To produce an improved article, an increased expence must be incurred in labour, attention, and time, while a considerable loss of weight will result from removing the outer part of the floss upon the cocoons, and the dirt and impurities which are now reeled with the silk; and as the manufacturers possess no capital, and are so poor as to depend for a market upon the spot, they are obliged to sell the silk to the native *bukkals*, who will not give more than a very trifling increase of price, as the present consumers are not particular about the quality of the material.

To encourage the manufacture of an improved article, it appears to me that the only way will be to purchase it upon account of government, when it can be shipped to England, and sold as the products of the Bengal government filatures used to be.

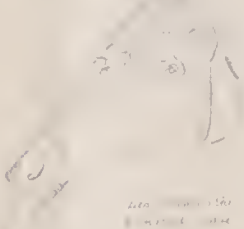
It is not probable that any encouragement to the manufacture would ensue from allowing the Native Revenue Officers to effect the purchases, for it is probable that they would make them at a low rate, and debit the government with a higher, or if the disbursement of the money was not entrusted to their hands, that they would exact a premium from the sellers before they granted acknowledgments for the receipt of the silk upon account of government.

By appointing an European superintendent, who might travel about the country and examine the quality of the silk prepared, and make the purchases at stated times, disbursing the price himself, much of the objections might be obviated, as subordinate native examiners and purchasers might be employed under him, upon whom a sufficient check might be kept up.

The government price might at first be fixed very high, as high as

Manis Crassicaudata

B



Left Forepaw

Left Hind Foot


a
b
c
d
e

Skull of Manis

Ballin & Le Lit

the selling price in London would admit of, as a premium rate ; after a certain sum had been disbursed, proportionate to the extent of the manufacture, the government price might then be annually and gradually decreased until it became low enough to enable the merchants of Madras to enter into competition, and make their purchases from the government sales in this country; as the government price became still further decreased, the Native *bukkals* upon the spot would at last, by raising their prices to the highest they could afford to give, at last take the purchases altogether into their own hands, and the purchases upon account of government might cease; while any immediate and considerable fall in price might be prevented by the government price being offered whenever the selling price fell low enough.

*Royacottah, 5th October,* 1841.

---

## MANIS CRASSICAUDATA., *(Auct.)*

M. Pentadactyla, *(Ibid).* Short-tailed or thick-tailed Manis.

*In Hindustan, generally called "Bujjerkeet."—Orissa, "Bujjer Kapta" and "Sooruj Mookhee."—By the Lurka Koles, "Armoo."—By Lieut.* R. S. Tickell, *Political Assistant, S. W. Frontier.*

Dimensions and description of a male specimen brought alive into hybasa, March 18, 1842, preserved and presented to the Museum of the Society, April 1842.

| | *Feet.* | *Inches.* |
|---|---|---|
| Extreme length from muzzle to end of tail, .... | 3 | $6\frac{1}{2}$ |
| Length of head, ..... | 0 | $4\frac{1}{2}$ |
| " of body, ..... | 1 | 8 |
| " of tail, ..... | 1 | 6 |
| From muzzle to inner corner of eye, .... | 0 | $2\frac{1}{4}$ |
| " Last to rim of ear, ..... | 0 | 1 |
| Top of back to roots of claws, (of fore feet,) following the curve of the body, ..... | 0 | 11 |
| Humerus, ..... | 0 | $3\frac{3}{4}$ |
| Radius, ..... | 0 | $3\frac{1}{8}$ |
| Carpus to roots of fore claws, ..... | 0 | $1\frac{1}{8}$ |

| | *Feet* | *Inches.* | |
|---|---|---|---|
| Outer claw, | 0 | $0\frac{1}{4}$ | Measured as chords to the curve. |
| Next ditto, | 0 | $1\frac{7}{8}$ | |
| Middle ditto, | 0 | $2\frac{1}{4}$ | |
| Index ditto, | 0 | $1\frac{1}{2}$ | |
| Thumb ditto, | 0 | $0\frac{3}{4}$ | |
| Femur, | 0 | 4 | |
| Tibia, | 0 | $3\frac{1}{4}$ | |
| Os calcis to end of foot, | 0 | 3 | |
| Girth round body about its centre, | 1 | 8 | |
| Breadth of tail below at base, | 0 | $4\frac{1}{2}$ | |
| Length of tongue, protruded portion, | 1 | $0\frac{1}{4}$ | |

*Teeth.*—None. *Mammæ* 2, pectoral. *Clavicles* ——— ?

*General aspect.*—Body and tail thick, the latter much flattened, the section would be an obtuse angle, with curvilinear apex. Limbs short, stout, very muscular; the entire figure giving evidence of the enormous power of the animal. Head small, with elongated muzzle, a well shaped nose, (somewhat as in a dog), small mouth; eyes very small, placed far backward, and close to the ears. Ears small, with rounded helix, scarcely any tragus, exceedingly simple (externally) with a very small concha. The anterior extremities furnished with long stout claws, of which the outer ones are almost rudimentary. These claws do not expand (naturally) beyond at eight angles to the sole of the paw, the animal therefore in walking bends them in and treads on the knuckles, or rather on the roots of the claws. The five claws of the hind foot are small, barely touching the ground, and the foot resembles that of a tortoise, being oval, with a thick, cushion-like sole. General outline of the figure much hogged or curved on the back, with the tail pressed flat along the ground.

*Tongue*—Is flatly or sub-cylindrical ending in a depressed point, consisting of a central cylindrical part, and two outer flattened or laminous edges. The tongue can be drawn above a foot out of the mouth, but it is doubtful whether the animal can voluntarily protrude it to such a length. When so far extended, the skin of the tongue towards the root in returning appears to admit the tongue back into itself, so that the latter has the appearance out like a telescope. It is all over covered with a slightly viscid saliva.

*Eye*—Is small, dull, pupil circular, and as in bats or moles, barely distinguishable from the iris. A very strong opaque nictitating membrane. No eye-lashes to either lid.

*Genitals (male).*—A small longitudinal slit, in the apex of a rounded soft wrinkled bag, with the anus immediately behind. Testicles internal. No apparent penis. The belly and the under-surface of the tail being on the same plane, and the latter not capable of bending upwards, it is difficult to imagine how the Manis copulates: not improbably face to face.

*External Covering*—The upper part of the animal, and the outside half of each limb are clothed with horny sharp-edged scales, not very regularly disposed except on the tail. The nose is bare, and excessively tender; about $\frac{3}{4}$ths of an inch from it commence series of scales, extending laterally to within $\frac{1}{2}$ an inch above each eye: these are small and hexagonal, and extend to the back of the head skirting the ears. From this point the scales of the back commence, they are looser, larger and more irregular in their order of imbrication; they are as nearly as possible disposed in eleven longitudinal rows, five on each side decreasing in size towards the belly, and one series along the dorsal line. On the tail are five series, the three central of which are regularly disposed. The scales of the lateral rows are bent or curved inwards, so that their long apices present a blunt edge along the whole length of the tail. In other words, these scales embrace or enclose the edge of the tail. The under part of the tail is flat, and covered with smaller rounded scales, which commence abruptly from a line about an inch in rear of the arms. The scales of the anterior limbs commence on a line down the middle of the inner side of the arm, from whence they diverge outwards and upwards, gradually assimilating (on the shoulder), to the order of the series on the back. The scales of the hind legs commence just below the knee, and the order of the series is downwards to the edge of the sole enveloping the outside semi-circumference of the limb. The nose, sides of the face, inside of the limbs, the entire thigh, and the whole of the under-parts to the root of the tail are naked and clothed with a soft whitish wrinkled skin. The soles of the fore-paws are smooth and flabby, (as they never touch the ground in walking.) Those of the hind feet, on which the animal rests, are black, tough, and spongy. The face is smooth, like that of a scalded pig, eyelids devoid of lashes. From be-

hind the eye to the throat the skin lies in transverse folds or creases, of which the most conspicuous is formed by a continuation as it were of the helix of the ear, extending round the jowl. On the belly the skin lies more in longitudinal wrinkles. Between and underneath the scales on all parts of the body are brownish bristly hairs, few and scattered, here and there a solitary one visible.

*Colour.*—Eyes black, nose dirty reddish or flesh-colour. All the bare parts pale brownish-white, a little darker or smudged about the muzzle. The claws a pale-horn or brownish-white. The scales pale-horny or clay-colour, those on the head darker and shaded with a brownish neutral tint. Under the tail also the scales are washed with a blackish tinge. Soles of hind feet blackish.

*Scales.*—The shape of the scale is, for the most part, on the head, hexagonal: on the body a rounded four-sided outline. Some scales more semi-circular, others more pointed. But all or most, so jagged and broken as to be very irregular; on the tail they are more evenly semi-circular. The series on each side the tail present two planes or surfaces, being bent down along the middle, so as to cover both the upper and under-surface of the tail. The scales are generally smooth exteriorly with sharp edges, underneath they are more or less marked with transverse ugæ.

*General remarks on the Viscera, &c.*—On opening the body, the viscera did not present the irregular or peculiar formation and arrangement which might have been expected from so singular an animal, and the general appearance of the contents of the body struck me, as far as my limited knowledge of anatomy allowed, as very like that of the human subject. The heart, large, shaped as in man, with two auricles, and two ventricles. The lungs of proportionate size, and of a remarkably bright colour. Diaphragm exceedingly thick and tough. The liver small, with two lobes, resting above the centre and right of the stomach, but not extending so far down as the latter. The gall-bladder exceedingly large, equal in size to that of a sheep. Pancreas and spleen situated as in man, and well proportioned. Kidneys very large.

The stomach shewed some remarkable peculiarities. The cardiac opening and pylorus apparently both on the same side, and close to each other. In the region of each, the stomach immensely muscular,

having the appearance of the gizzard of rasorial birds. The left half of the stomach thin, membranous, and distended with wind. Œsophagus very small. The different parts of the intestines not distinguishable. There appeared to be a duodenum 8 or 10 inches in length, and the rest seemed to be ileum, being of the same size throughout, slender and much convoluted, till it ended in the rectum, which is very large. No cœcum was discoverable. The stomach is very large, extending almost entirely across the abdomen. The two muscular portions above noticed, felt to the hand as hard and round as racket balls, and rather larger in size. On opening the cardiac division, it was found to be full of gravel, quartz stones nearly half an inch long, the debris of large black ants, and a perfect bundle of intestinal worms. These were long, thin, cylindrical, semi-transparent, from one to two inches long, and pointed at either end. The muscular portion near the pylorus contained the debris of the ants, more digested and approaching the appearance of fæces, mixed and hardened by the mixture of gravel, but without the large stones. The left and largest portions of the stomach was a mere thin membranous bag, distended with wind, and here, as well as in the cardiac gizzard, and even in the œsophagus, the worms swarmed. The fæces of this animal when ejected are peculiar, being in the shape of black, shining, truncated cylinders, about $2\frac{1}{2}$ inches long and $1\frac{1}{2}$ in diameter. Void of smell, and dry, with no appearance of having been affected by bile.

The glandulæ renales large, and communicating by a duct, through a double glandular-looking perforated excrescence, into the urethra, not far from its mouth. No external parts of generation visible, except the opening of the urethea, which is prodigiously large. On either side, and within the skin are two well proportioned testicles; but no where could I detect the trace of a penis. Close in front of the orifice of the urethra, is a sinuosity or fall in the skin, resembling a shallow rudimentary sac. It appeared like a navel, but I could discover no communication from it inwards. These do not appear to be any secreting glands or follicles about the anus, although the animal emits a peculiar and offensive odour.

The subject from which these remarks are taken, died with its long tongue protruded, and for about 20 hours before dissolution it was unable to retract it. This prevented my being able to see the manner

in which the tongue, when within the mouth, is folded up. But a great part of the basal portion, as before observed, appears to slide into itself, or into the outer skin of the tongue, and probably lies along under and in front of the œsophagus.

The process of skinning the animal for preservation was extremely toilsome and difficult, on account of the scales being deeply imbedded in the skin, which is indented throughout by them, the hollows so formed being filled up by the dorsal muscles. All the muscles and tendons are of great toughness, the flesh having a harsh and coarsely fibrous appearance. The pectoral muscles and those of the forearm and neck (platysma myoides) are of prodigious volume, and the latter covered with masses of fat, which I at first took for large conglomerate glands.

The bones are short, thick, and with reference to other animals disproportionably powerful. The dorsal and caudal vertebræ perfectly immense, ribs 13 pair, of which the last 5 pair false. The stout, solid sternum has its ensiform process elongated almost to the centre of the abdomen, or beginning of the umbilical region, that is, to where the umbilical region generally is, for in this animal I suspect the navel is quite close to the genitals. This ensiform process is in shape like a young plantain leaf, and has a thin pair of muscles spreading along each side of the centre or stalk. The skull is long and narrow, and apparently without sutures. The zygomatic arch small, lower jaw very weak; nasal bones much elongated, and suddenly truncated at the muzzle. The brain very small in volume. I was unable, from want of time, to examine with sufficient attention whether the animal possesses clavicles or not; my impression however is, that they are wanting.

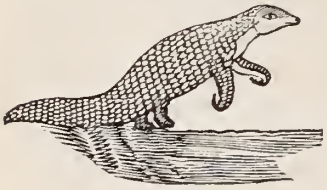
*Remarks.*—The Manis is the rarest quadruped, I imagine, in India, owing perhaps as much to its habits as to want of numbers. During six years' residence in and near the forests of Singbhoom, I have only seen two living specimens. It is, however, not confined in locality, being known throughout Central India, where in the upper provinces it is called "Bajjerkeet." In Orissa and Bengal "Bajra Kapta" and "Sooruj Mookhee," and in the old Shunskrit still applied to many words further south, on the Peninsula, in the Madras presidency, "Vajra Keeta." By the Lurka Koles it is called "Armoo," and in the islands of the Eastern Archipelago, "Pangoe-ling." "It has been described also

in our books of Natural History, under the name of Phattagen, and Manis." The Manis Crassicaudatus and M. Pentadactylus, (Auctorum,) are I suppose one and the same.

*Habits, &c.*—In Singbhoom the Armoo lives principally in the neighbourhood of rocks, from whence it rarely wanders. The specimen from which the present details were taken was captured on a pretty high hill. Of its manners very little is known, as the animal is strictly nocturnal, and its retreats, in the fissures of rocks, are so impenetrable, that I have never heard of the young being seen or taken. In Shaw's Zoology, in Geoffroy's Cuvier, and in other works, the Manis is represented upon a branch of a tree; but I very much doubt whether it possesses the power of climbing, although its fore claws are not unsuited to the purpose. Its food also, which consists of large black ants, is found as much upon trees as on the ground; but the weight and clumsiness of the animal impeded by a stiff tail which scrapes along after it, is repugnant to the idea, and of those people who have met with them in the jungles, none ever mentioned seeing one on a tree.

Quitting, however, doubts and conjectures, I shall content myself with describing the manners of two specimens I had alive for some days in my possession. One was brought to me in 1838. It had been captured by some Koles at dawn of day, on the ground, in a patch of low jungle or bush; being unable to progress beyond a slow trot, or to bury itself fast enough in the ground, it was easily taken. The animal has no means of offence; when handled or even approached it rolls itself into a ball, tucking its nose (the only part about which it appears solicitous) under its belly, folding in its legs, and wrapping the tail round all. When brought to me and laid on the ground, it remained for some time in this position, but at length cautiously unrolled itself, looking about and sniffing the air in all directions. The slightest noise, or knocking and scraping on the ground near it, would make it instantly resume its former position, from which the united strength of two men could not unwind it. If, however, left unmolested, it would after a little reconnoitring thrust forth, first one leg, and then the other, and so, starting to its feet, commence perambulating the apartment. In walking it stepped upon its knuckles, or more strictly upon the roots of its fore claws, which were bent closely inwards to the leg, the tail pressed to the ground. Its gait was slow and cautious,

and the animal frequently reared itself on its tail and hind legs, as if to listen more attentively. In this posture it would remain either erect or at any angle with the ground, and nothing could give a clearer idea of the almost supernatural strength of the muscles of the back and loins, than the perfect ease with which the position was assumed and retained, a strength only equalled, in the animal world, by those species of caterpillars, well known to Entomologists, which sustain themselves for hours in attitudes which no other animal could endure for more than a few seconds. The annexed diagram will give some idea of this fact. The animal appears to be in an unnatural position, out of balance, and as if about to fall forward, but such is not the case, and the attitude here sketched is one I have often seen it assume, and sustain without the slightest apparent effort. On one occasion, while stumping about the room, the Manis passing under a heavy bookstand, containing four large shelves filled with books, (a weight which I do not think two stout men could have lifted off the ground,) tilted the whole affair up, so as to cause a general rush to the spot, to avert the threatened overthrow! Being left to itself in a large room, but precluded from going out, it made several tours of the apartment, and at length throwing itself on one side, commenced excavating into the wall, which was of sun-dried bricks, and in about two minutes had dug out a hole large enough to cover itself. In doing this it disturbed a colony of white ants, whose galleries ran along under the plaister, but I could not perceive that it paid them the least attention. It being impossible to chain the animal, as it suffered nothing to touch its head, I kept it shut up in an empty beer-chest, the lid of which was rendered (as I imagined) secure, by large stones heaped upon it, to the amount of four or five maunds. In this manner I kept the animal about a week, during which it got pretty tame, seldom rolling itself up when touched or patted. It drank water freely at all hours of the day, lapping it up with its long tongue, and seemed fond of lying in it; but it took no food of any kind. Earth-worms, larva of kinds, and white ants were equally unnoticed; yet the animal appeared in no way weakened or suffering from hunger; and its weight, which was very



great, remain apparently undiminished. At last one night, it tossed off the ponderous lid placed on its box and made its escape, no traces of it being discoverable the next morning.

The second specimen I had in my possession, and which furnished the description here given, was brought me by some Koles in March 1842. It had been caught on a hill, at some distance from Chybasa, and in the midst of jungles. I had not unfortunately any opportunity of enquiring into the particulars of its capture. As I was then just about to leave Chybasa, I had it put into a box, and carried banghy fashion, along with my petarahs. During a three days' journey, it refused to eat anything, like its predecessor, but drank water. About the fourth day it began to grow more and more lethargic, remaining doubled up in its usual posture of repose. It was placed at night on a white ant hill; and at other times, black ants and larvæ were placed before it, but it refused nourishment, and after much protracted suffering, died during the night of the fifth day. Its tongue, which appeared paralyzed, remained protruded for the last 20 or 24 hours, till the end had become dry and shrivelled up. On being opened, there were found, as has been before related, swarms of intestinal worms in the stomach, which, and not starvation, might perhaps have caused its death, for there was a quantity of the remains of ants in the stomach, and the rectum was full of fæces. One hind foot of the animal had also been cut off, but the wound appeared an old one, though it still smelt offensively. The whole body, especially on the soft skin underneath, and between the scales, was covered with disgusting swarms of ticks, and the animal was altogether filthy in the extreme. Both these specimens (of which the first mentioned was much smaller) were perfectly gentle and harmless. The former one would when handled, hiss like a snake, and this was the only sound I ever heard either of them emit. They slept rolled up in a ball.

One of these animals, in the possession of Captain Hannyngton, Assistant to the Governor-General, South-west Frontier at Poorulia, that gentleman described as having been much larger than mine, and of a clear whitish colour. It also was never observed to eat any thing, although allowed to ramble about the garden, (under surveillance,) and eventually made its escape, which it effected, (curious to say,) in the same way, and under the same circumstances as did the first animal, above alluded to.

Hindoos ascribe great virtues to the scales of these animals in the cure of Hœmorrhoides, but how they are applied I know not.

The subject of these notes I had the honor to present to the Society's Museum on my arrival in Calcutta. And a few days ago while visiting the Museum, had an opportunity of seeing the skin of a specimen agreeing apparently with the animal described to me by Captain Hannyngton. In this skin, there is a slight variety or modification of form in the shape of the lateral scales of the tail, sufficient perhaps, (if established by an examination of two or three more specimens,) to constitute a new species. Mr. Blyth, the Curator, who brought this fact to my notice, will have, it is to be hoped, the opportunity of being able by and bye to examine more specimens of the kind, and thus establish a new species, or reject a mere accidental variety. The one I have been describing, I see no reason to suppose other than the Manis Pentadactyla, or Crassicaudata of authors.

*Calcutta, April* 16, 1842.

---

*On the Theory of Angular Geometry. By* S. G. Tollemache Heatly, Esq.

The following paper is intended to examine the properties of angular magnitude in a light, which has not hitherto attracted sufficient attention.

It is usual among elementary writers, to express the fundamental idea of an angle by the phrase—" mutual inclination of its containing lines." These are the words of Laplace in his Leçons at the Ecole Normale, and are in substance those of the great majority of Geometers before and after him. When, nevertheless, we have to eliminate any property relative to angles, it is well known that this definition becomes a dead letter; and it is found necessary to superadd an explanation which embodies as much more of the fundamental idea, as enables us to compare angles together. It amounts usually to saying, that angles are compared with each other by comparing the openings at their vertices: and that the magnitude of an angle depends on the *width*, and not on the *longitudinal extension* of that opening, if it may be permitted so to use the words in italics.

An advanced student, who has acquired the idea in question, will find nothing very objectionable in thus expressing himself, for he knows what is to be described, and mentally assigns a due scientific meaning to the general term of common parlance. But to the beginner, there appears something as vague in the word "inclination," as in the term "direction," when applied to a straight line. It even appears more vague, for the genus of a straight line is given—it is the *line* of direction: but the angle, is it then inclination itself? The student is apprised, that his attention is to be confined to points, lines, surfaces, and solids, things of which he has definite conceptions: but here at the very outset is a subject introduced, which appears to be distinct from all, and to be a *quality* of figure rather than an existence. It afterwards turns out that the only practically useful explanation relative to an angle requires merely, that it should *measure* this quality of position.

Considerations of this nature have induced some distinguishedly successful elementary writers, to deviate from the usual custom in seeking for such a definition of an angle as should appear to be a natural description of it, to be free from metaphysical objections, and to permit of *immediate* use in the investigation of the properties of angles, or failing that, through medium of such simple considerations as may appear almost axiomatically deducible from the definition.

Of this class is Bossat's statement, that the angle is the opening between two lines, with an explanation impressing the definiteness of the conception, and the mode of comparison naturally resulting from it. This was followed by Professor Young in England. But the nature of the idea thus attempted to be expressed by the word opening, did not seem to be yet satisfactorily developed, and Legendre, accordingly ventured to substitute "quantity" for "opening." The American edition of Brewster's translation calls an angle, "the quantity by which two intersecting lines are separated from each other;" and Francœur, I presume after Legendre, adopts a similar definition in his admirable *course*. It is, however, easily seen, that very little is gained by this step, on the score of clearness or precision, as the *kind* of quantity is not specified.

Leslie attempted quite another path, suggested by the cerelations of angles and arcs; viz., that angular magnitude is generated by the revolution of a line round a fixed point: but we are not told what angular

magnitude *is*. All these definitions then fail in strictly fulfilling their object. Each has been in turn severely criticised by following reviewers, anxious to establish the validity of the most infallible of all—their own. But all agree in this; that they are descriptions of different characteristics of the same idea. If from any one we can obtain a definite conception of what is intended, we immediately perceive that all are sufficiently correct to recall it to our minds. All agree in understanding angular quantity to be "something," or if the expression be too bold, "that" which lies between two intersecting straight lines. All of them agree further in considering, that for purposes of comparison as to magnitude, angles must be estimated crossways, or by the width between the lines, and not with any reference whatever to the longitudinal extension in the direction of the sides.

Now, if we analyse the various definitions of an angle in this manner, it is, I think, impossible to come to any other conclusion than that an angle is the plane surface between two lines; of a peculiar nature, partly bounded and partly unlimited, whose value could *consequently* be only estimated by reference to the bounded direction, that is, the width between the sides. And the neatest and shortest mode of expressing this will apparently best solve our difficulty, as it connects axomatically an explicit definition with the working one.

The first place in which I believe this idea was embodied, was Bertrand's celebrated solution of the difficulty in the theory of parallels. The principle of that demonstration is as follows: Any angle, however small, can by repeated reduplication be made to exceed any given angle however great, but the band of *unlimited space* between two parallel lines, though repeated ever so often, will never fill up that given angle. Hence an inter-parallel space is less than any assignable angle in value, and therefore a line which cuts one of two parallels, must also cut the other, otherwise the angle which it makes with the one it does cut, would be wholly contained within the inter-parellel space, and be less than it. The stress of this demonstration evidently rests on the comparison of surfaces, and it is surprising that its extreme elegance did not lead Geometers earlier to seek the solution of the problem in that direction. The truth is, that the new "unlimited spaces" were treated as interlopers in the science of figure, and the demonstration rejected, as "wearing only the semblance of geometrical accuracy."

In Col. Peyronnet Thomson's* Geometry without Axioms, these unlimited spaces are for the first time distinctly enunciated. The fourth edition of that work contains the following paragraphs :—

" The latest innovation has been the assertion, that an angle (or " the thing spoken of by Geometers under that item, whether they knew " it or not) is a plane surface." Pref. page x.

" The plane surface (of unlimited extent in some directions, but limit- " ed in others) passed over by the radius vectus in travelling from one " of the divergent straight lines to the other, is called the angle between " them." " Hence," adds the Colonel, " angles are compared together " by their extension sideways only, without reference to the greater or " smaller length of the straight lines between which they lie."

After making this decided step however, Colonel Thomson stops ; the definition is registered in his Book of Nomenclature, but he establishes the properties of angles by the old criterion of supposition. Not only indeed does the definition remain a dead letter, but the gallant radical reformer in Geometry as in Politics,

" Astonished at the sound himself had made,"

virtually doubts its correctness, when at page 14, reviewing the proof of M. Bertrand, he says, " All references to the equality of magnitude " of infinite areas are intrinsically paralogisms."

The edition in question of " Geometry without Axioms," was reviewed in the 13th No. of the Journal of Education, in an article which betrays the sparkling pen of Professor De Morgan. The part relative to angles is noticed thus : " His is the first work, which we know, in which this " idea (that of a plane surface) is fairly brought before the beginner. " We suspect he is quite right, and that in the extension of the term " *equal* to unlimited figures which coincide in all their parts, will be " found the ultimate resting point of the theory of parallels. Had our " author stuck close to his definition, the demonstration of Euclid's axiom " given by M. Bertrand, ought to have been sufficient." After noticing the neglect of Colonel Thompson to make any use of his definition, as well as his attack on unlimited spaces, the reviewer proceeds: " We " wonder therefore that the definition should have been inserted, for it " is in the definition only, and the difficulty which a beginner must find

* The well known Editor of the *Westminster Review*, and author of the *Corn Law Catechism*.

"in settling his ideas of greater, less, and equal on that definition, that "the whole objection to M. Bertrand's demonstration turns."

I have been minute in these quotations, not only because they contain all that to my knowledge has been developed on a very interesting subject, but also in the hope that they may draw further attention. Led independently to similar conclusions, by attempting to trace the natural affinities, if we may so term it, of geometrical truths, with the intention of forming a definite arrangement of them, I was induced to trace their consequences in establishing the various relations of angular space. The results of the inquiry may be thrown into a connected chain of propositions, as subjoined.

*Definition* 1.—The plane surface between two straight lines, bounded in the one direction, unlimited in the other,—is called an *angular space*.

*Definition* 2.—When an angular space is bounded on one side by the intersection of the containing lines, it is called an *angle*.

*Definition* 3.—The point of intersection is called the *vertex*, and the containing lines are called the *sides* of the angle.

*Axiom.*—From the definition, it will follow that two angular spaces A B C D, and E F G H, must be compared thus: If placing the line F E on B A, we find that, F falling on the point P, G will fall on some point Q in C D, then according as the line G H falls within, upon or without the line C D—is the angular space A B C D, greater than, equal to, or less the angular space E F G H. (Fig. 1.)

*Definition* 4, 5, 6.—Euclid's definitions of right, acute, and obtuse angles.

### *Proposition* I.

Every angular space is equivalent to its angle.

This follows from the axiom, since the sides of the angular space, and of the angle are identical, and may therefore be considered to coincide.

### *Proposition* II. *(Fig. 2.)*

All right angles are equal to one another.

Let the right angles A B C, E F G, be made respectively by A B with B C and E F with F G; they are equal. Produce C B to D and F G to H, and apply the figures one to the other, so as to make F coincide with B and G H with C D. If then F E do not coincide with B A, let it fall

as B K. Then G F E = C B K ∠ C B A ∠ (its = ) A B D ∠ K B D ∠ E F H.

But G F E = E F H by definition, hence the supposition, that F E does not coincide with B A involves absurd consequences, ∴ F E does coincide with B A, and G F E with C B A, G F E is therefore equal to C B A.

*Cor.* 1.—A right angle is therefore a *constant* in angular magnitude.

*Cor.* 2.—The space on one side of a straight line, considered as an angle at some given point in the line, is two right angles.

*Scholium. (Fig.* 3.*)*

Consider a line O A fixed, and another line O R, having a point O in common with O A, but being itself in a state of rotation round O. When in the position O R, it will have generated an acute angle A O B : as it proceeds, it will coincide with the perpendicular O B, and will have described a right angle. In the position O $R_2$, the angle generated is an obtuse one. The generating line then coincides in its progress with O C, the continuation of O A. It will in such position have described two right angles (A O B and B O C). Supposing the rotation to continue, O R will fall below O C, as O $R_3$, having described the whole of the coloured angular space, which is greater than two right angles. Such angle is called a *reverse* angle. During the progress of the line, the reverse angle continues to increase, equals 3 right angles, exceeds that amount, and at length equals 4 right angles, when O R has completed an entire circuit. By conceiving the line to move on, still revolving, and with the aid of a contrivance like the spiral twisted palm-leaf fans, used by the Natives, the beginner may obtain the idea of angles greater than four right angles, and generally of $(2\ n\ \bar{n} + A)$ which some find it difficult to understand in their later trigonometrical studies, and perfect acquaintance with which is so indispensable to the comprehension of periodic functions.

*Proposition* III. *(Fig.* 4.*)*

The vertically opposite angles made by two intersecting straight lines, are equal to one another.

The vertically opposite angles A E D and C E B made by the intersectors A B and C D at E are equal. For C E D being a straight line, the angular space on the side of it towards A is two right angles. For

a similar reason, the space on that side of A E B towards C is equal to two right angles. These two angular spaces being constantly equal, take away from both the common angular space A E C, therefore the remainders are equal, viz. the angles A E D and C E B.

*Scholium.*

It may be useful to devote an angular space by *two* letters, one from each side, if the angle be less than two right angles, or by *three* if the angle be two right angles or more, to prevent the confusion of direct and reverse angles. Thus in Fig. 4, C B would stand for the angular space corresponding to C E B; A C B for the two right angles between E A and E B: and D A C B for the reverse angular space between E D and E B. The demonstration of III may then be made shorter, and perhaps clearer, thus: C E D being a straight line, D A C=2 right angles; also because A E B is straight, A C B=2 right angles, Hence D A C=A C B; take away the common part A C, then A D=C B. that is the angle A E D=C E B.

*Proposition* IV. *(Fig. 5.)*

If the angle contained by two straight lines is equal to two right angles, those straight lines form but one continued line.

For if A B, A C including an angle equal to two right angles, are not in the same straight line, let A D be the continuation of A B: then D C B is two right angles, but C B is the same by hypothesis, ∴ D C B = C B an absurd result; therefore A C and A B form but one line.

*Proposition* V. *(Fig. 6.)*

If any number of straight lines tend towards the same parts, the angle made by the extremes is equal to the sum of the angles made by the successive pairs of lines.

Let A, B, C and D be straight lines, tending towards the same parts, then the angle A H D is equal to the sum of the angles A E B, B F C, C G D formed by the successive pairs of lines. For the angular space A B C D is equal to the sum of the three angular spaces A B, B C and C D. But A B C D is the angle A H D and the constituent angular spaces A B, B C, C D are respectively identical with the angles A E B, B F C, C G D. Hence A H D = A E B + B F C + C G D.

*Proposition* VI. *(Fig. 7.)*

The three angles of a triangle are together equal to two right angles.

Let A B C be the triangle, produce A B, A C to E and F and the base B C both ways to D and G. Then since the lines D B, E B, F C, G C all tend towards the same parts, the angular space D E F G = D E + E F + F G. But D E is the angle D B E or its vertically opposite A B C; E F corresponds to the angle B A C and G F is the angle G C F or A C B. Also D E F G is the angular space contained by two portions of the same straight line, it is therefore two right angles. Hence

$$\text{A B C} + \text{B A C} + \text{B C A} = 2 \text{ right angles.}$$

*Cor.* 1.—The exterior angle is equal to the two interior and opposite, on the same side, proved by reversing the process of Euclid in the 32. I. or as well thus (see *Fig.* 7.) The angular space E G is equal to E F and F G : E G = E B G; E F = B A C and F G = F C G = A C B

$$\therefore \text{G B E} = \text{B A C} + \text{A C B.}$$

*Cor.* 2.—Euc. I. 16 and 17 are further contained in the last corollary.

*Proposition* VII. *(Fig.* 8.*)*

The interior angle of a polygon of $n$ sides are together equal to (2 n — 4) right angles.

Let A B C D E F be the polygon; subdivide it into triangles by lines from one of the points A. Then the angles of the polygon are equal to the angles of the triangle taken together. Each of the polygon, *save the two meeting in A*, corresponds to one of these triangles, therefore the number of triangles, is n — 2. And the sum of the angles in each is 2 right angles, ∴ the sum of all the angles is (n — 2) × 2 right angles. That is, (2 n — 4) right angles. Hence the angles of the polygon are equal to (2 n — 4) right angles.

*Proposition* VIII. *(Fig.* 9.*)*

The exterior angles of a polygon, whatever be the number of sides, are together equal to 4 right angles.

The whole angular space F G H K L F is composed of the angular spaces F G, G H, H K, K L, L F. But the whole space F G H K L F is the entire angular space on both sides of the line F E, i. e. 4 right angles, and each of the constituent angular spaces corresponds to an

exterior angle of the polygon. Hence the exterior angles together amount to 4 right angles.

The above eight Propositions comprise all the properties of intersecting lines which are independent of the consideration of *length* and size. They shew how possible it is to translate the *spirit* of the principle of homogeneity from analytical into geometrical inquiries; for our *results* being altogether free from the comparison of triangles or the length of lines, the interweaving of those subjects in our *processes* raises a suspicion, that we are not proceeding so simply as we might do, but are embarrassed with matters really foreign to the direct truth. We might extend the same course to parallel lines.

*Definition.*—Straight lines that never intersect each other, are called parallel lines.

*Proposition* IX. *(Fig.* 10.*)*

If a straight line meet two others, so as to make the exterior angle equal to the interior and opposite on the same side, these two others shall be parallel.

Let C B E meet A B and D E making A B C = D E B, then D E must be parallel to A B. For the angular space D C = D A + A C and D C is D E C, and A C is A B C,

$$\therefore \text{D E C} = \text{D A} + \text{A B C}, \text{ but D E D} = \text{A B C}.$$

$\therefore$ D A is zero, or D E and A B contain no angle, therefore they never meet, for if they met, they must contain an angle; hence they are parallel.

*Cor.*—This proposition proves the possible existence of parallels.

*Proposition* X. *(Fig.* 10.*)*

If a straight cuts a pair of parallels, it makes an exterior angle equal to an interior and opposite one on the same side.

For as before D A C = D A + A C, but since D E and A B never meet, they contain no angle, i. e. D A is zero; hence D A C = A C or the angle D E B = A B C.

*Cor.*—It would be a waste of space to deduce from this, the other usual properties of parallels.

*Proposition* XI. *(Fig.* 12.*)*

Straight lines parallel to the same are parallel to each other.

A and B being each parallel to C, B is parallel to A. For A C = A B + B C, but A C and B C are each a zero, ∴ A B is also zero, or B parallel to C.

*Proposition* XII. *(Fig.* 13.*)*

If a straight line cut one of two parallels, it must cut the other.

A C, meeting A B, not meet *its* parallel G D, parallel to E D, consequently A C, A B being both parallel to E D, are parallel *inter se*, which is not the case.

The only other property of parallel lines not included in the above is, that two straight lines which are respectively parallel to two others contain an angle equal to the angle of those others. But there is nothing peculiar in its demonstration. These thirteen propositions contain a complete and homogenous *geometry of position* as contra-distinguished from that of *magnitude:* I speak of course relatively to lines. It is scarcely necessary to refer the student to the Third Book of Euclid, as far as relates to the consideration of angles in a circle, to shew how much this mode of treatment, and the introduction of reverse angles would simplify the subject, as well as prepare him for analytical inquiries by generalising his ideas on it.

Postscript.

In looking over some of the mathematical articles of the Penny Cyclopedia, written by Professor De Morgan, I have subsequently to the writing of the above, found a confirmation of my views as to the nature of the angle under the heads, "Angle" and "Infinite."

The former proposes to introduce the axiom, that "two spaces whether of finite or infinite extent are equal, when one can be placed upon the other, so that the two shall coincide in all their parts." After which it is remarked, that Bertrand's demonstration becomes rigorous. This also considers an interparallel space viewed as an angle to be zero, as I have done, since it is less than any assignable angle.

The latter has the following passage:—

"The comparison of such infinite spaces is therefore possible, consistently with perfect clearness in the meaning of the terms employed, and a simplicity of reasoning which would convince any one who is capable of the most ordinary thought. Had Euclid been accustomed

" to the modes of thinking which involve the idea of infinite magnitude " under any form whatsoever, it may be reasonably suspected that he " would admit the following axiom, *Magnitudes which can be made to " coincide in all their parts are equal*, as applicable to infiniteas well as to " finite spaces. Not having done so, the adherence to his standard has " to this day excluded the only proof of the theory of parallels, which " does not assume the axiom of Euclid, or an equivalent."

---

*Remarks on the Essay " on the Theory of Angular Geometry." By Capt.* Shortrede.

A definition is perfect, when it includes all that has the property intended to be defined, while it excludes all that has it not.

If we would have a true definition of *angle*, or of any thing else, it is of the utmost importance that we have a clear idea of the thing, and then use such words as plainly to convey the idea. If there be any neglect in either of these, our definition must necessarily be imperfect.

Geometry as commonly defined, treats of *figured space*. If this definition be correct, (and I find no fault with it), then it is plainly improper to introduce indefiniteness, or boundlessness, or infinity, as part and parcel of the definition of a thing or idea, of which the property signified by these terms, is not *necessarily* a part. I can conceive of an angle formed by finite lines: unboundedness is therefore not necessary to the *idea* of angle, and therefore ought not to form a part of the *definition*.

Since the idea of *angle* is somehow sooner or later convertible to, and commensurable by that of *circular arc*, every attempt at defining angle should be made with this in view, otherwise the definer will discover, (or some one will discover it for him), that his definition is not perfect.

As the author of this Essay introduces unlimitedness in the containing lines as part of his definition of *angle*, I do not see why the plane surface of a hyperbola between its assymptotes may not be angle, as well as the thing intended by him. If it be said, the meaning is the *whole* plane surface between the lines, I rejoin that the *whole* plane surface being unlimited, I cannot form an idea of how much it is.

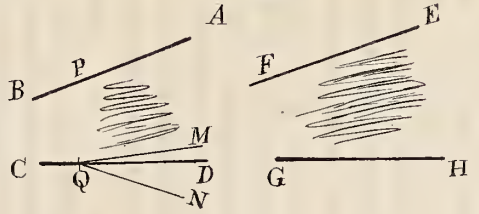


Fig 1
A
B
P
C
Q
M
N
D
E
F
G
H

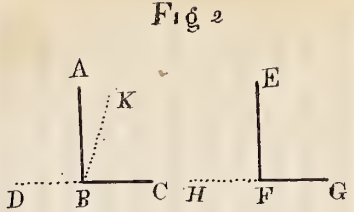
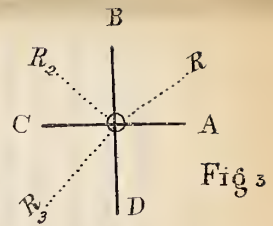


Fig 2
A
K
D
B
C
E
H
F
G


B
R2
R
C
A
R3
D
Fig 3

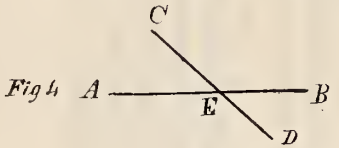
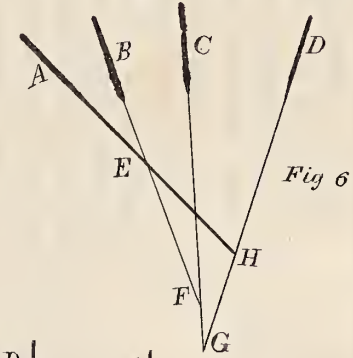
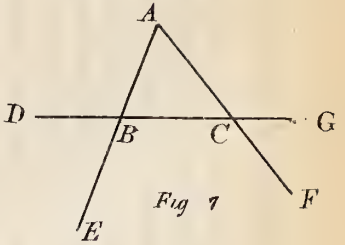


Fig 4
C
A
E
B
D


Fig 5
C
D
A
B


A
B
C
D
E
H
F
G
Fig 6


A
D
B
C
G
E
F
Fig 7

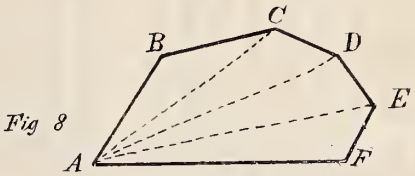
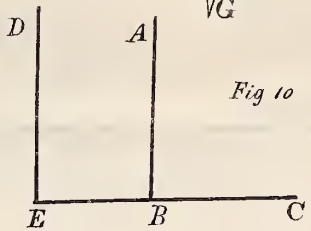


Fig 8
C
B
D
E
A
F


D
A
Fig 10
E
B
C

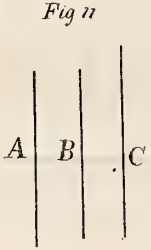


Fig 11
A
B
C

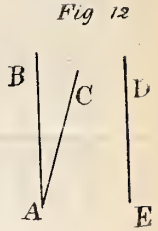
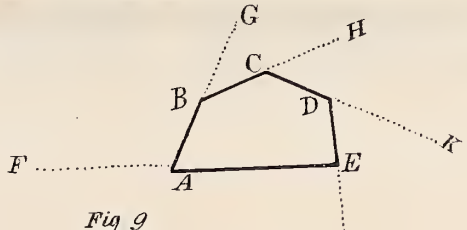
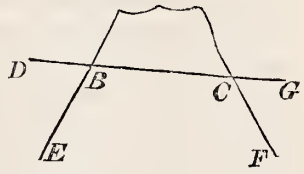


Fig 12
B
C
D
A
E


G
H
C
B
D
K
F
E
A
Fig 9

The definition has other faults: instead of saying "bounded in one direction, unlimited in the other," he should have said bounded in *two* directions, unbounded otherwise, (or elsewhere): for surely the thing meant is bounded by *two* straight lines, and therefore in *two* directions. Moreover, not unlimited, but *unbounded*, is the opposite of *bounded*. If any where, surely in geometrical definitions, it is indespensible that words should be used with strict propriety, so as to avoid confusion. With equal propriety it might be said, that the angle A B C + the angle B C D = the corner A B D.

As I hold that the definition of angle here proposed is a failure, so likewise is the demonstration of the property in Prop. VI., that the sum of the three angles of the triangle are equal to two right angles; and for the same reason. The space E F below the line D B C G may belong to the angle A, or to any thing else, as in the annexed figure.




Instead of systematizing and refining till we get our ideas into an atmosphere too sublime for them to be of any use, we may take in common sense view of the subject. In the triangle A B C lay a ruler on the line A B, marking the ends towards A and B with the corresponding letters. Turn the ruler about A, till the end marked B come into the direction A C; then let it turn about C, till the end A come into the direction C B; and finally let it turn about B, till the end B come into the direction B A. The ruler has thus turned about each of the three angles, and the ends marked A and B have changed places, shewing, that the sum of the three angles of the triangle are equal to quantity formed by turning a straight line half round, or to two right angles.

In like manner, if we measure the exterior angles of the triangle of any polygon, the ruler at last will have the same direction as at first, after having gone completely once round; or after having described four right angles.

If I were to write a Treatise on Geometry, I should without hesitation introduce these as demonstrations of the theorems regarding the interior angles of a triangle, and the exterior angles of any polygon. They have long appeared to me to be quite as evident and satisfactory as any principles in Geometry. A good treatise should be something like a

good map, shewing not merely one high road through the country, but also the principal cross-roads connecting the different parts of the country with each other. In point of fact, no one is considered to be master of the subject, till he be pretty fully acquainted with these cross-connections.

We may chop logic as long as we please, but after all there is precisely the same difficulty in conceiving straight lines to be lengthened by producing them, as in conceiving angles to be increased by the continued revolution of one of the sides about a point, or by the lengthening of the circular arc measuring them. Each is accomplished by motion. The straight line is produced by another straight line laid partly upon it, and partly beyond it, or by conceiving the line to move along itself, all points between the fore-end of the old line, and the rear end of the new being common to both lines. In like manner, an angle or circular arc is increased either by a line revolving about a point, or by conceiving the arc to move upon itself, so as to have all the points between the fore-end of the old arc, and the rear end of the new arc, common to both arcs. In this way the idea of a fixed centre is unnecessary for any but the first part of the arc, just as the idea of a fixed direction is unnecessary for any but the first part of the straight line.

---

*Notes on the Recent Earthquakes on the North-Western Frontier. By Lieutenant* R. Baird Smith, *Bengal Engineers.*

On the forenoon of Saturday, the 19th of February 1842, a severe shock of an Earthquake was experienced at different points in the countries on our North-Western Frontier, and extending thence it affected, although with much reduced intensity, several of the districts of the North-Western Provinces.

The remotest point at which its devastating influence was experienced, and relative to which any authentic intelligence has yet reached us, was the city of Jellalabad, where extensive injury was done to the fortifications and to the buildings throughout the place. The motion of the earth is described as having been of an undulating character, producing symptoms similar to those of sea-sickness in many of the persons who felt it; and in one account it is asserted, that the ground opened and closed again with loud noise in several places. Such a

phenomenon is a very common accompaniment of a severe Earthquake, and by the extent to which it occasionally reaches, has proved one of the most fatal causes of destruction to life and property. The details of the effect of the Earthquake at Jellalabad are very brief and imperfect; this is, however, simply what might have been anticipated from the circumstances under which the gallant force now there are placed, but we shall probably at a future time obtain information of a more definite and satisfactory character. Three bastions, with, I presume, their connecting curtains, are said to have been levelled with the ground, and a painful interest is attached to this particular effect of the shock, from its having thrown open the defences of the small but resolute body of troops then occupying the city, and exposing them to an assault from the Affghans, at a time when they must necessarily have had much internal confusion to contend against. In darker times, superstition would have tended to unnerve still more our brave friends, but on this occasion their courage appears to have risen even above the level of their difficulties, and brilliant success in repelling the assault was no more than the well-merited reward of their devotedness and energy.

From Jellalabad the shock affecting a portion of the Suffied Koh range of mountains, with the numerous subordinate ranges that diverge from these, reached Peshawur. From the circumstance of General Pollock's force being encamped at Kawulsur, about eight miles from Peshawur, and the communication being uninterrupted, our details are much fuller, and more satisfactory, than would otherwise have been the case.

The following extracts from letters published in the *Delhi Gazette*, give the most perfect account of the different effects of the Earthquake that I have been able to find, although it is much to be regretted, that on the most important point, that namely, of the exact time of the occurrence of the shock, much discrepancy exists.

---

*Extract from a Letter, dated Kawulsur, 20th February,* 1842.

"Yesterday a fearful Earthquake visited this part of the world. The shock, which came on between 10 and 11 o'clock was long continued, and men, horses, tents, even the ground under us, and the hills in the

distance, appeared to be moving. It was an awful visitation, and made every heart quake. In the direction of Peshawur, (eight miles distant,) clouds of dust appeared, which proved to have been caused by the falling of very many houses and buildings. A salute was fired from the battery at Jumrood, for the purpose of announcing the safety of Rajah Pertaub Sing, son of Maharajah Shere Sing, who is now at Peshawur, and of whom it is said, he narrowly escaped death; the building in which he had been sitting, came down almost immediately after he quitted it. The natives say, that a tenth of the city is down, and a number of the inhabitants killed."

---

*Extract from a Letter, dated Kawulsur, 19th February,* 1842.

"It is now about 12 o'clock mid-day, and we have just experienced a most awful Earthquake in camp. The natives say, that nothing so severe of the kind has been experienced in India for the last fifty years. The earth literally trembled like an aspen leaf, and rocked to and fro as an infant's cradle, or a ship at sea. Many of the camels that were carrying the baggage of the troops moving up to Colonel Wild's camp were thrown down, and so great was the shock, *which lasted fully five minutes,* that I was obliged to support myself by holding on to the camp furniture, and many of the officers fancied themselves suddenly taken ill. I expected every moment to have seen the earth open and swallow us up, and it is only by God's great and merciful providence, that we have escaped through such an awful convulsion of nature.

"Every one complains of nausea. We have just been observing immense volumes of dust, that completely darken the atmosphere in the direction of the old ricketty town of Peshawur, which is supposed to be nearly levelled with the ground, as the houses are but weakly built, being merely propped up by the beams of wood which may be observed placed in different spots under large walls and corners of the houses, and are even dangerous to passers-by at all times. I doubt not but that to-morrow's dawn will bring us dreadful intelligence, and produce a fearful account of lives lost.

20*th February.*—"Reports say, that only from 40 to 50 of the inhabitants of Peshawur were crushed and killed among the ruins of the falling houses. General Avitabile's large dwelling house, which had

recently been built, and was being finished, fell in, but luckily it did no injury to any one living in the house."

It will be observed, that the writers of these interesting letters differ at least an hour and a half, or two hours in their estimates of the time at which the shock was felt at Kawulsur, the first placing it between 10 and 11 A. M., the other at noon. By comparing the periods of the occurrence at stations farther removed from the focus of disturbance, as at Delhi, Poojnah on the Doab Canal, Saharunpore, and other places, to which more specific reference will immediately be made, I am disposed to consider the first of these estimates as the most correct, and to fix the period of the shock at Kawulsur at very little after 10 A. M.

Travelling in an easterly direction, the next notices we have of the Earthquake is its being felt at Delhi, where its period appears from all accounts to have been about 10 minutes past 11 A. M. On reaching Delhi, both the intensity of the shock, and the rate of propagation of the undulations seem to have materially diminished; and beyond the motion of the ground, no other effects are alluded to.

Still continuing easterly, and in a direction very little removed from a right line between the two places, the shock travelled from Delhi to Poojnah, a station on the Doab Canal, where its effects were observed by Serjeant and Assistant Overseer J. R. Renny, and the following details connected with them were forwarded by him to me.

---

*Extract of a Letter from Serjeant Renny, dated Poojnah, 19th February,* 1842.

"I also beg leave to inform you, that we felt a very severe shock of an Earthquake here at about half-past 11 A. M., it lasted *about three minutes* with intervals. My whole family felt it, as well as the people about my place, who came running to me much alarmed. It was first noticed, I believe by myself, as I was then sitting writing, and found a heavy table on which my desk was laid, much agitated, which I thought was caused by some one moving, but I soon found my chair in motion also, and on looking about, I perceived every thing moveable in the room in a state of agitation. A few hours before

this, I observed the water in the Canal was unusually muddy, and after the shock was over I went to look, and found the water much disturbed by a high swell, whether occasioned by the shock or not, I cannot say."

These details are unusually complete and interesting, and are very creditable to Serjeant Renny's powers of observation. The unusual muddiness of the Canal cannot possibly be due to the influence of the Earthquake, since the direction in which the shock travelled was against, not coincident with that of the current in the Canal, hence the disturbance of the silt in the bed could not *precede* the shock; but it is quite possible, that the high swell observed *after the shock had passed*, may have been occasioned by it. The muddiness was probably caused by a fall of rain in the upper part of the Canal.

From Poojnah the shock travelled to Saharunpore, where it was just felt, but attracted no particular attention. It was next experienced at Kulsea, another station on the Doab Canal, fourteen miles to the northward of Saharunpore, where its effects were very perceptible. The motion here, as described to me by Mr. Sub-Conductor Pigott, was of the same undulating character as at Kawulsur, but its duration was certainly not more than a minute. Immediately on observing the shock, Mr. Pigott ran to the sun-dial, and found it precisely noon, or 12 o'clock. My camp was pitched about two miles north of Kulsea, on the south bank of the Nowgong Row, (or Stream,) but so feeble was the intensity of the shock, that although I was conscious of some peculiar motion at the time, it never occurred to me that it arose from an Earthquake, and it had passed from my mind, till recalled by Mr. Pigott's account of what had been felt at the same time at Kulsea.

By combining the preceding details, some interesting points may be determined; and first, as to the rate of progression of the undulations. The maps I have had it in my power to consult, were not all so good as I could have wished, and the distances mentioned may possibly be a little incorrect, but not so, I believe, to any great extent. From Jellalabad to Peshawur, measuring in a straight line across the spurs of the Suffied Koh, the distance is 70 miles. From Peshawur to Ferozepore, measuring similarly in a straight line, the distance is 280 miles, and from Ferozopore to Delhi 250, in all 600 miles. The period of the shock at Jellalabad is not mentioned, but at Peshawur

it may be taken at 10 A. M., while at Delhi it was 10 minutes past 11 A. M., hence then 530 miles were traversed in 1 hour and 10 minutes, or the shock travelled at a rate of 7.571 miles per minute, or 454.26 miles per hour. This, it is to be observed, is an average rate, and the velocity at Jellalabad and Peshawur was doubtless much greater, but a much more multiplied series of intermediate observations than we now have, would be necessary to enable us to form even an approximative idea of the law of decrement of rate of progress with reference to distance travelled. From Delhi to Poojnah is about 50 miles, and the times consumed in travelling from the one place to the other was 20 minutes, consequently the velocity of the shock was 150 miles per hour. Again, the distance from Poojnah to Kulsea is very nearly 36 miles, and the time 30 minutes, so that the velocity had diminished to 72 miles per hour, supposing the times to have been correctly observed, which, within a small limit, was probably the case. Hence then we have,

| | *Miles.* | |
|---|---|---|
| Rate of progress of shock from Peshawur to Delhi, | 454.26 | per hour. |
| ,, ,, from Delhi to Poojnah, | 150 | ditto. |
| ,, ,, from Poojnah to Kulsea, | 72 | ditto. |

We may next attempt to form some estimate of the breadth of the undulations, of which there appear to have been several, although no data are furnished, from which we can learn either their number or individual extent. We must therefore content ourselves with estimating the total breadth of the zone of disturbance, as it may be called, at different points.

The duration of the shock at Kawulsur is said to have been 5 minutes, and supposing the velocity to have been there twice the average between Peshawur and Delhi, or 15.142 miles per minute, the breadth of the disturbed zone would be 75.71 miles, or in five minutes, a series of terrestrial waves, whose united breadth was this number of miles swept past Kawulsur. This is a horizontal measurement; but of the vertical height of the waves, on which their destructive influence chiefly depends, we can form no estimate, yet it must have been considerable, if we may judge from the ruin caused.

At Poojnah, the duration of the shock was considered to be three minutes, the velocity 2.5 miles per minute, and therefore the breadth of the disturbed zone was here 7 miles. While again at Kulsea, where

the duration was one minute and the velocity 1.44 miles per minute, the breadth was 1.44 miles.

Whence we have,

| | *Miles.* |
|---|---|
| Breadth of zone of disturbance at Kawulsur, | 75.71 |
| ,, ,, ,, at Poojnah | 7.00 |
| ,, ,, ,, at Kulsea, | 1.44 |

Whatever may be the effective cause of Earthquakes, whether undulatory motion communicated to internal masses of fluid matter, and from thence communicated to the super-imposed crust of the earth, or vibrations propagated from foci of disturbance through the solid crust itself, or a combination, as some facts would intimate of both these causes, there are two modes in which we may conceive these motions to be spread abroad. First, they may proceed in gradually enlarging circles, (as when a stone is thrown into water,) the focus of disturbance being the common centre; or they may be propagated along a distinct and defined track, (as when a string or wire is seized at one extremity and motion communicated to the whole from this,) when the focus of disturbance would be at one end. In the first case we would expect the effects of the Earthquake to be felt at points equi-distant from the centre at times approximating, but not exactly coincident both with each other, as the rate of progress of the undulations would necessarily be affected by the nature of the rocky crust through which they were propagated. In the second case, we would expect, that while the effects of the shock were more or less severe within certain limits, beyond these limits none would be experienced. All the information I have been able to collect tends to shew, that the Earthquake of the 19th February 1842, belonged to this latter class, and if lines be drawn through Peshawur, Ferozepore, &c. with parallels through Jellalabad, which as yet forms the southern limit of the track, it will be found that the breadth of the district affected by the shock was somewhere about 40 miles, and in it are included the mountain ranges to the south, east, and west of Peshawur, with a considerable portion of what has been called the Salt range. This estimate has been formed solely from the facts collected by myself, and it may yet require to be much modified as our information extends. The method of what may be called the linear, in contradistinction to the circular propagations of Earthquake shocks, appears to me to lead very distinctly to the conclusion, that in

such cases, the original seat of the disturbing forces must necessarily fall short of the centre of the earth, and also be unconnected with any such continuous fluid nucleus, as many suppose to exist at no very great distance from the surface. When from the action of any disturbing cause, the equilibrium of a continuous fluid mass was deranged, the resulting motions would be communicated in all directions radiating from the point of original disturbance, and if this was near the centre of the earth, the movements ought to affect its whole surface, so that shocks would be experienced nearly simultaneously over the whole world. But however extensive may be the connection of certain Earthquakes on record, we have nothing approaching to any such universality of effect as this, and the theory of local action (using this expression in a large sense) appears to agree best with the present state of our knowledge relative to the phenomena of Earthquakes and their causes.

On the night of the 5th of March, 1842, another very severe shock was experienced, which appears to have been more limited in its range than the preceding, and exhibited essentially distinct phenomena. The motion in this instance, instead of being like the rounded swell of a fluid or viscid mass, was sharp and sudden, like the effect of a concussion, than of an undulation, and seemed indeed to be a much magnified "jarr," similar in kind to that experienced by the hand when a hammer held by it, is struck forcibly on a hard unyielding body. One intelligent friend, who was in his study when the shock occurred, described the effect to be, as if he and his chair had received a sudden and severe blow from behind, by which they were impelled forward, while to me, it seemed as if my chair had been suddenly lifted from the ground, and dashed down again with great force.

The following interesting detail of the effects of the shock, as experienced at Berkeri, a station on the Doab Canal, about 20 miles south of Saharunpore, was communicated to me by Serjeant and Overseer J. Petrie, to whom I feel much indebted for the trouble he has taken in preparing it.

---

*Letter from Serjeant John Petrie, dated Berkeri, 5th March,* 1842.

Sir,—We had a very smart shock of an Earthquake here at 9 o'clock this evening; so much so indeed, that every thing in this bungalow shook and rattled again. I had just laid down to rest with a book

in my hand when it came on, and I started up and called out for assistance, thinking the house was coming down. Every one about the place felt it, and came running to me. I found that the south door of the inner room, which I had bolted before I went to bed, had been forced open by the bolt falling down. Indeed every thing in the house shook, and I was very much afraid of its falling, after having read the accounts from our Army near Peshawur. At that place, a number of houses have been destroyed, and many lives lost, from the last Earthquake.

---

Although this shock did not last so long as the one of the 19th of last month, in my opinion it was much more severe for the time.

The rate of propagation of this shock appears to have been great, since no perceptible difference was observed in the times of its arrival at the following places: Simlah and Mussoorie in the Himalayas, Deyrah in the Deyrah Dhoon, Saharunpore, and Berkeri. There is, therefore, every reason to think, that on this occasion the shock was propagated after the circular method, as I have defined it above, and the nature of the shock appears to indicate, that the seat of the disturbing force was either within the rocky crust of the earth, or at a very small distance indeed beneath it. Such a supposition is necessary to account for the peculiar "jarring" sensation characteristic of this shock. Its effects appear to have been most severe at Deyrah, where a large house is said have been split from top to bottom, but no particulars of this accident have reached me. I am somewhat disposed to think that the actual force of disturbance was situated somewhere in the valley of Deyrah, and propagated thence to the hills on one side, and to the plains on the other; a more extensive collection of facts would however be necessary to give probability to this impression, and these have not in this instance been collected. It may be stated, however, that all who had experienced both shocks in this neighbourhood, concurred in opinion that they came in different directions, and as the first was from West to East, it is not impossible the second may have been from North to South. The southern door of the inner room of the Berkeri Canal bungalow, which is stated by Serjeant Petrie to have been driven open by the shock, would on the above supposition receive the first impulse, and the effect produced upon it, tends in some measure, to confirm

the view I have taken of the direction in which the shock was propagated.

The occurrence of Earthquakes throughout these provinces, and indeed throughout India generally, is so frequent, and their connection with geological theories of such an interesting character, that it is highly desirable to facilitate, as much as possible, the collection of minute, well authenticated, and carefully detailed facts relative to these various phenomena. I will therefore conclude this note, by pointing out briefly those points on which information is peculiarly desirable, and the attention of observers is earnestly solicited to them.

1. *The Time.*—The startling discrepancies that occur in regard to time, in otherwise most satisfactory accounts of Earthquakes, indicate the great necessity for precaution in observing it, since it is undoubtedly the point on which the most interesting conclusion relative to such occurrences must be based. When, therefore, the period of a shock is marked by a watch, means ought to be taken, whenever possible, to verify the time shewn by this watch, by some simple celestial observation, or some data should be given by which the time could be ascertained independently within very trifling limits, as for example, by a specification of the exact length of the shadow of a vertical object of fixed and determinate length, on a horizontal level, at a precise moment, not too near noon; or if near the coast or at sea, the first appearances and last disappearances of the sun's upper and lower border, above and below the sea horizon, etc.* Without this minute identification of time, it is impossible to maintain the connection of shocks felt at far distant places; calculations of the rate of progress of the undulations or vibrations can only be approximative, and other interesting points are rendered inconclusive.

2. *The Duration.*—On this point also, the most striking discrepancies are to be observed, arising no doubt from each observer making his own sensation the measure of duration, and estimating the latter without reference to some determinate standard. When the mind is intently occupied either by feelings of alarm or intense interest, it is wholly unfitted for estimating duration correctly, and the watch ought only to be trusted. The general tendency is to make the duration

* Sir J. Herschell's Meteorological Instruction, Prof. Papers, Roy. Engrs. vol. ii.

of shock longer than it really is, and in most instances, considerable deductions might with safety be made from recorded observations on this point, to bring them near the truth. The duration of intervals between shocks should also be carefully noted.

3. *Nature of the Shocks.*—This is very frequently twofold: one kind throws the crust of the earth into a tremulous state. This was the nature of the shock of the 19th February. The second kind is of the nature of a concussion or blow, and does not always occur. Sometimes both of these are conjoined in one and the same shock, and the latter is felt generally in the middle of the former.

4. *Nature of the motion on the Earth's surface.*—Three different varieties of this have been observed. First, a horizontal motion by which bodies are, as it were, pushed horizontally forward. Second, a vertical motion by which they are lifted up and dashed down again. The conjunction of these two kinds of motion produces the third, which is of an undulatory character, partaking both of the horizontal and vertical movements. This kind is the most frequent of all, and produces those sensations of nausea, so commonly alluded to.

5. *Rents in the ground and subsidencies* are very common accompaniments of Earthquakes, and their appearance ought to be represented on paper, and their dimensions carefully measured. These are often accompanied by *loud noises* of various kinds.

6. *Meteorological phenomena* are highly important, and some curious and interesting relations have been observed, between these and the occurrences of Earthquakes. This is especially true as regards the state of the barometer and thermometer, and the electric condition of the atmosphere. Such points therefore merit peculiar attention.

7. *Geological structure of affected District.*—When the observer is qualified to furnish information relative to this, his remarks will be additionally important, as it has been observed, that in localities exhibiting certain geological features, Earthquakes always occur with much greater frequency than in others. Wherever powerful and extensive volcanic action has occurred, where faults and fissures communicating with the internal seats of disturbing forces are found, there Earthquakes occur with greater frequency and higher intensity, and they are frequently observed to pursue a direction, parallel to that of the principal faults or fissures.

8. *The direction of the Shock.*—I am not aware of any instrument having yet been actually employed for ascertaining this point, but the following simple apparatus has been proposed for the purpose by Prof. Babbage, in his admirable little volume on the Economy of Manufactures and Machinery; and although it must be confessed, that several of the schemes he has proposed in that work, remind us a little of the designs of the sages in Swift's College of Laputa, this is not one of them, but seems adapted to its proposed object.

"An earthquake," he remarks "is a phenomena of such frequent occurrence, and so interesting both from its fearful devastations, as well as from its connexion with geological theories, that it became important to possess an instrument which shall, if possible, indicate the direction of a shock, as well as its intensity. An observation made a few years since at Odessa, after an Earthquake which happened during the night, suggests a simple instrument by which the direction of the shock may be determined.

"A glass vase, partly filled with water stood on the table of a room in a house at Odessa; and from the coldness of the glass, the inner part of the vessel above the water was coated with dew. Several very perceptible shocks of an Earthquake happened between three and four o'clock in the morning; and when the observer got up, he remarked that the dew was brushed off at two opposite sides of the glass, by a wave which the Earthquake had caused in the water. The line joining the two highest points of this wave, was of course that in which the shock travelled. This circumstance which was accidentally noticed by an Engineer at Odessa,* suggests the plan of keeping, in countries subject to Earthquakes, glass vessels partly filled with treacle or some unctuous fluid, so that when any lateral motion is communicated to them from the earth, the adhesion of the liquid to the glass shall enable the observer, after some interval of time, to determine the direction of the shock.

"In order to obtain some measure of the vertical oscillation of the earth, a weight might be attached to a spiral spring, or a pendulum might be sustained in a horizontal position, and a sliding index be moved by either of them, so that the extreme deviations might be

* Memoires de l'Academie des Sciences de Petersburgh, 6me series, tome i. p. 4.

indicated by it. This, however, would not give even the comparative measure exactly, because a difference in the velocity of the rising or falling of the earth's surface would affect the instrument."

Were observers always to employ vessels of the same dimensions, as for instance hemispherical cups of earthern-ware, painted white interiorly, having a diameter of ten and a depth of five inches fixed on a standard a foot in height, and filled for two inches of their depth by a fluid as nearly as possible of the same tenacity as treacle, the observations made at different points would be comparable with each other, and it would perhaps be a simpler method of estimating the intensity of the shock, than either of those proposed by Professor Babbage, were a graduated semi-circular arc to be fitted inside the cup, and the difference between the highest and lowest points of the wave caused by the shock, to be observed from it. This difference would be in a certain degree proportional to the intensity, being greater, as it was greater and less as it was less; and although it would after all be but a rough approximation, still it would be interesting, and worthy of remrak.

The discussion of all local observations ought to be undertaken by one person, who by combining them properly, would be able to deduce general results of the highest interest. It may be long ere we can find any means of protection against the appalling, and apparently irresistible effects of such convulsion as Earthquakes, but if observation confirms the idea of their connection with a certain geological structure of country, we shall at least be able to point out where danger is to be peculiarly apprehended, and by avoiding such localities, diminish the fearful records of death and suffering, by which the occurrence of Earthquakes has hitherto been accompanied.

It will afford the writer the highest satisfaction to be furnished with detailed accounts of Earthquake shocks, in whatever part of India they may occur; and in any cases in which the expence of Postage may be a consideration to observers, he begs they will have no hesitation in forwarding their remarks to him "bearing."* The subject is one of deep interest and importance, and the co-operation of observers in all parts

* Communications on the subject of Earthquakes may be addressed to the author at Saharunpore, Upper India, or if preferred, he has no doubt the pages of this Journal will be cheerfully opened to them.

Most unquestionably. Any number of copies of any such paper will be printed and stitched as a pamphlet for (gratis) distribution, and distributed as required, or sent to the author.

of the country is earnestly solicited, since it is only by wide-spread observations that justice can be done to the subject, and such observations it is quite impossible for any single individual to collect satisfactorily.

*Saharanpore, 5th April,* 1842.

---

*Notice of the predatory and sanguivorous habits of the Bats of the genus Megaderma, with some Remarks on the blood-sucking propensities of other Vespertilionidæ. By* Edward Blyth, *Curator to the Asiatic Society.*

Chancing, one evening, to observe a rather large Bat enter an out-house, from which there was no other egress than by the door-way, I was fortunate in being able to procure a light, and thus to proceed to the capture of the animal. Upon finding itself pursued, it took three or four turns round the apartment, when down dropped what at the moment I supposed to be its young, and which I deposited in my handkerchief. After a somewhat tedious chase, I then secured the object of my pursuit, which proved to be a fine pregnant female of *Megaderma lyra.* I then looked to the other Bat which I had picked up, and to my considerable surprise, found it to be a small *Vespertilio,* nearly allied to the European *V. pipistrellus,* which is exceedingly abundant not only here, but apparently throughout India, being the same, also, to all appearance, as a small species which my friend Dr. Cantor procured in Chusan : the individual now referred to was feeble from loss of blood, which it was evident the *Megaderma* had been sucking from a large and still bleeding wound under and behind the ear; and the very obviously suctorial form of the mouth of the *Vampyre* was of itself sufficient to hint the strong probability of such being the case. During the very short time that elapsed before I entered the out-house, it did not appear that the depredator had once alighted; but I am satisfied that it sucked the vital current from its victim as it flew, having probably seized it on the wing, and that it was seeking a quiet nook where it might devour the body at leisure. I kept both animals wrapped separately in my handkerchief till the next morning, when procuring a convenient cage, I first put in the *Megaderma,* and after observing it some time, I placed the

other Bat with it. No sooner was the latter perceived, than the other fastened on it with the ferocity of a Tiger, again seizing it behind the ear, and made several efforts to fly off with it, but finding that it must needs stay within the precincts of the cage, it soon hung by the hind-legs to one side of its prison, and after sucking its victim till no more blood was left, commenced devouring it, and soon left nothing but the head and some portions of the limbs. The voidings observed very shortly afterwards in its cage resembled clotted blood, which will explain the statement of Steedman and others concerning masses of congealed blood being always observed near a patient who has been attacked by a South American *Vampyre*.

Such, then, is the mode of subsistence of the Megaderms. The sanguivorous propensities of certain Bats inhabiting South America have long been notorious, but the fact has not heretofore been observed of any in the old world*; and the circumstance of one kind of Bat preying upon another is altogether new, though I think it not improbable that the same will be found to obtain (to a greater or less extent) among the larger species, if not throughout the whole extensive allied genus of *Rhinolophus*, (or the horse-shoe Bats,) which, like *Megaderma*, are peculiar to the Eastern world.

It may appear strange, that with the multitudinous attestations ascribing blood-sucking habits to certain Bats of South America, naturalists have been found unwilling to credit the statement, as instanced by Mr. W. S. McLeay, who, in a note appended to the remark that a

* There are, it is true, certain vague statements, but quite unworthy of credit, ascribing sanguivorous habits to the *Pteropodes*. Thus De Vaux, in his 'Letters from the Mauritius,' (p. 65), describes these animals to "feed indiscriminately on fruit, small warm-blooded animals, and insects, as well as to suck the blood of men and cattle." But were this the case, the fact would assuredly be well known in India, where "Flying Foxes," as they are termed, are so very abundant. Of one brought alive into France, it is indeed stated, that "during the voyage, on one occasion when its food ran short, it fastened upon a dead fowl, and made a meal of part of it; and from that time animal food was occasionally given to it:" but I doubt much whether this was a natural appetite of the creature, from observation of one exhibited in England by Mr. Cross, of the Surrey Zoological Gardens, and *puffed* by him in advertisements and hand-bills as the wondrous "*Vampyre*." This animal would eat nothing but fruit and vegetables, and constantly refused insects, a variety of which I offered to it. It was tame, and appeared fond of being noticed. Hence I am also inclined to doubt a statement which I have somewhere met with, to the effect that the little Kiodote is partly insectivorous, this animal being known with certainty to feed largely on the fruit of the *Eugeniæ*.

particular species of butterfly, inhabiting Cuba, is much preyed upon towards the evening by different species of Bats, adds "principally the *Phillostoma Jamaicense* [*Arctibeus Jamaicensis*, Leach]. By the way," remarks this observer, "in the 2d edition of the *Règne Animal*, the author says of the Phillostomes, 'Ce sont des animaux d'Amerique, qui ont l'habitude de sucer le sang des animaux;' I can only say that this is not only quite untrue as respects the Cuban species, but perfectly impossible [!]. The *Ph. Jamaicense*, for instance, lives on fruits and winged insects, in search of which latter it will be found in bed rooms. The *Vampyre* Bat of South America is also a *Phyllostoma* of Cuvier and Geoffroy; but until some person having pretension to the name of naturalist shall establish the fact on personal observation, I shall as readily believe that it sucks the blood of men as that the *Caprimulgus* sucks the milk of goats."—*Trans. Zool. Soc.*, I, 187.

This is rather a sweeping denunciation of the detailed assertions of Condamine, Steedman, and a host of others, though there is now every reason to conclude that Mr. McLeay is perfectly correct, so far at least as regards the *Phyllostomata* attacking large animals; and concerning this genus, too, he mentions a fact which is not generally known, stating that its members are partly frugivorous. The same is, however, also noticed by Mr. Swainson, who informs us, (*Class. Quadrupeds*, p. 94,) that "several of the Brazilian Bats are likewise frugivorous, and to such a degree, that we remember never having been able to secure a ripe fig from a garden we possessed at Pernambuco, and where many of these trees grew: nets, indeed, were spread over them, but the cunning animals seemed to have the instinct of mice; they crept under the smallest opening, and completely baffled our endeavours to stop their plunderings." But this author also notices the sanguivorous habits of at least some South American species, mentioning that, "Our horses and mules, after having arrived at the end of a day's journey, and been turned out to graze, would be brought in by the guides in the morning with their shoulders covered with blood."

To be brief, in all instances wherein the habits of the *Phillostomata* have been directly observed, the result has corresponded with the above statements. Mr. Waterton, for example, tells us, in his celebrated 'Wanderings,' "As there was a free entrance and exit to the *Vampyre* in the loft where I slept, I had many a fine opportunity of paying atten-

tion to this nocturnal surgeon. He does not always live on blood. When the moon shone bright, and the fruit of the banana was ripe, I could see him approach and eat it. He would also bring into the loft, from the forest, a green round fruit, something like the wild guava, and about the size of a nutmeg. There was something, also, in the blossom of the suwarrè nut tree, which was grateful to him; for on coming up a creek, on a moonlight night, I saw several Vampyres fluttering round the top of the suwarrè trees, and every now and then the blossoms, which they had broken off, fell into the water. They certainly did not drop off naturally, for on examining several of them, they appeared quite fresh and blooming. So I concluded the Vampyres picked them from the tree, either to get at the incipient fruit, or to catch the insects which often take up their abode in flowers.

"There are," according to Mr. Waterton, "two species of Vampyre in Guiana, a larger and a smaller. The larger sucks men and other [mammiferous] animals; while the smaller seems to confine itself chiefly to birds. I learned from a gentleman, high up the river Demarara, that he was completely unsuccessful with his fowls, on account of the small Vampyre. He shewed me some that had been sucked the night before, and they were scarcely able to walk." He then proceeds to give a humorous account of his companion, a North Briton, who had been bitten by one of these creatures, and lay muttering imprecations on the whole race of them. "As soon as there was light enough," writes Mr. Waterton, "I went to his hammock, and saw it much stained with blood. 'There,' said he, thrusting his foot out of the hammock, 'see how these infernal imps have been drawing my life's blood.' On examining his foot, I found that the Vampyre had tapped his great toe: there was a wound somewhat less than that made by a leech; the blood was still oozing from it. I conjectured he might have lost from 10 to 12 oz. of blood.

"I had often wished," continues this observer, "to have been once stung by the Vampyre, in order that I might have it in my power to say it had really happened to me. There can be no pain in the operation, for the patient is always asleep when the Vampyre is sucking him, and as for the loss of a few ounces of blood, that would be a trifle in the long run. Many a night have I slept with my foot out of the hammock, to tempt this winged surgeon, expecting that he

would be there; but it was all in vain; the Vampyre never sucked me, and I could never account for his not doing so, for we were inhabitants of the same loft for months together."—(pp. 174—9).

The very obvious inference is, that the large *Phyllostomata*, which Mr. Waterton, in common with Steedman and the mass of other narrators of the doings of the Vampyre, have accused of this blood-sucking propensity, are totally innocent of the charge, as regards at least their attacking human beings or other large animals; but that there does exist a true Vampyre, capable of inflicting wounds such as described, which most assuredly the formidable canines of the *Phillostomata* are quite unfitted for, is equally evident from the above cited testimony alone. According to Condamine, "The Bats, which suck the blood of horses, mules, and even men, when they do not secure themselves from them by sleeping under a tent, are a nuisance, common to most of the hot countries of America, and some of them are of a monstrous bigness [?]: at Borja, and in divers other places, they have entirely destroyed the great cattle, which the Missionaries had introduced, and which had begun to multiply in those parts." In corroboration of this account, an accomplished modern traveller, Mr. Schomburgh, has assured me, that at Wicki, on the river Berbice, no fowls could be kept on account of the ravages of these creatures, which attacked their combs, causing these to appear white from loss of blood. Goats resisted them best, but even hogs were attacked by them.

In the report of the Committee of the French Academy, upon the results of M. Alcide d'Orbigny's late expedition, published in the 'Nouvelles Annales du Museum,' III, 90, we are informed, that "Dans l'ordre des Carnassiers, M. d'Orbigny a surtout étudié les *Vampyres*, dont il a pu confirmer les habitudes de sucer le sang des animaux, et même de l'homme, et cela sur ces gens et sur les mulets de sa caravanne. L'avidité de ces animaux pour le sang est telle, que les naturels sont obligées pour y soustraire de passer la nuit dans des moustiquaires, et de renfermer soigneusement leurs poules et autre animaux domestiques. Le Vampyre choisit, en géneral, la nuque, le cou, ou le dos de la victime, afin qu'elle puisse plus difficilement s'en d'ebarasser; auqu'elle fait cepandant en se roulant sur le dos."

Thus far we have still no satisfactory information as to what is the real depredator, for not only is there strong presumptive evidence that this cannot be the *Phillostoma*, as currently supposed, but the real habits of

this group, so far as positively observed, would appear to be solely frugivorous and insectivorous. To Mr. Charles Darwin we owe the solution of this mystery. "The *Vampyre*", writes this accomplished naturalist, "is often the cause of much trouble, by biting the horses on the withers. The injury is generally not so much owing to the loss of blood as to the inflammation which the pressure of the saddle afterwards produces. The whole circumstance has lately been doubted in England, and I was therefore fortunate in being present when one was caught on a horse's back. We were bivouacking late one evening near Coquimbo, in Chili, when my servant, noticing that one of the horses was very restive, went to see what was the matter, and fancying he could distinguish something, suddenly put his hand on the beast's withers, and secured the Vampyre. In the morning the spot, where the bite had been inflicted, was easily distinguished from being slightly swollen and bloody. The third day afterwards we rode the horse without any ill effect.

"Before the introduction of the domesticated quadrupeds," continues Mr. Darwin, "the Vampyre Bat probably preyed on the Guanaco, or Vicugna, for these, together with the Puma, and Man, were the only terrestrial mammalia of large size, which formerly inhabited the northern parts of Chili. This species must be unknown, or very rare, in Central Chili, since Molina, who lived in that part, says that no blood-sucking species is found in that province."

The specimen here referred to, is now deposited in the Museum of the Zoological Society, and is referrible to the genus *Desmodus* of Prince Maximilian of Saxe Nieud, or *Edostoma* of d'Orbigny, differing very widely in its dental characters from *Phillostoma*, or indeed any other animal previously known. Its entire structure is expressly modified for the *Vampyre's* mode of subsistence. It has only two upper incisors, corresponding to the ordinary middle pair of the *Primates* generally, and which, ordinarily larger than the others, here attain their maximum of development to the exclusion of the latter: they are large, and of singular form, approximated, and occupy the whole space between the canines, are longitudinally bent abruptly inward near the median line, and prolonged and acutely pointed at the tip of the bend, being received into a cavity or sheath behind the lower incisors when the mouth is closed, the under-jaw consequently projecting beyond the upper: together with analogousl ancet-shaped canines, which are thinly compressed laterally; they form an admirable instrument for blood-let-

ting, inflicting a triple puncture like that of a leech: the lower canines are small and not compressed, and there are four bilobate inferior incisors, the medial separated by a wide interval. Instead of the sharply tuberculated molars of the Phyllostomes, and of that division in particular styled *Vampyrus* by systematists, there are even no true molars whatever, intimating that the accustomed food requires no mastication; but there are two false molars immediately behind the canine in the upper-jaw, and three antagonizing with them in the lower, that present only keenly cutting edges, adapted for severing in the manner of a pair of scissors. Nor is this all:—as in carnivorous animals, wherein the food is more readily assimilated, the intestines are consequently less prolonged than in vegetable-feeders, so in the present most remarkable genus, where blood—warm from the living veins, and even quickened by the vital principle,—constitutes the aliment, the intestines (as I have been informed) proceed almost straight to the anus. In short, we have here an animal duly organized for the mode of life so often described, which the *Phillostomata* are not; and there can scarcely be a doubt that numerous species of *Desmodus* exist in tropical America, being everywhere the veritable *Vampyres* which attack man and other large animals, as a general rule during their sleep, and inflicting wounds so gently with their keenly pointed and lancet-like instruments of incision, that no sense of pain follows to awake their victim. Nevertheless, admitting the great probability of this, there still remain some matters for further explanation, to which my discovery of the predatory habits of the *Megaderma* seems to afford a key.

Among the South American *Vespertilionidæ* having teeth of the ordinary conformation, Professor Bell describes the tongue of the *Phyllostomata* to have "a number of wart-like elevations, so arranged as to form a complete circular suctorial disc, when they are brought into contact at their sides, which is done by means of a set of muscular fibres, having a tendon attached to each of these warts."* Now, for what purpose can this be? For drawing forth the juices of fruits? I suspect not: and Spix, it may be remarked, expressly designates his *Glossophaga amplexicaudata*, (which, however, presents another modification of the tongue, this being slender and elongate, and furnished with hair-like papillæ,) *Sanguisuga crudelissima*, a very cruel blood-sucker; an expression which would seem to imply habits analogous

* Dr. Todd's *Cycl. Anat.* and *Phys.*, Art. *Cheiroptera*.

to those of the Megaderms; for these bite away at their victim in savage earnest, while drawing the life-blood from its veins. In short, there are two classes of blood-sucking Bats,—one gentle and insidious, which attack any large animal during its sleep, are expressly organized for this purpose, and doubtless derive their whole sustenance in this way,—and another openly rapacious, which ferociously attack (it may be presumed) any small warm-blooded creature that they can master, and more especially, it is probable, prey on the smaller and weaker members of their own tribe, first drawing their blood, and then devouring them, as instanced by the oriental Megaderms; and to this latter class, I imagine, many of the large leaf-nosed Bats of South America appertain (though also known to feed both on fruit and insects), and probably also at least the larger *Rhinolophi*.*

With regard to the *Megaderma lyra*, I am of opinion (founded on further observation of the captive animal), that it is in no degree whatever frugivorous, and the structure of its mouth would imply that it is no insect-hunter; neither do I think it evinces any disposition to attack small birds, either at roost or moving: but I am led to infer that the smaller *Vespertilionidæ* constitute its main, if not sole, subsistence, and suspect that these are seized while on the wing, and carried off to be devoured at leisure in some quiet recess, the preyer meanwhile sucking the vital fluid from the neck of its victim. There is more energy about it than I have observed in any other kind of Bat, at least during the day: go when you will, it is always lively and on the alert; and the expression of its physiognomy is far from dull, having comparatively large eyes for a Bat, which are bright and prominent. The species does not appear to be rare about Calcutta.

I may further remark, that the inguinal teats are well developed in this genus, as in the *Rhinolophi;* equally so, indeed, with the pectoral teats, insomuch that no one who examined them could suppose that they are mere sebaceous glands, as suggested by Prof. Bell in the case of the *Rhinolophi*. This fact is not uninteresting with relation to the described position of the teats in the genus *Cheiromys*.

* The tongue of the Megaderms presents nothing remarkable in its conformation; but the lips are, in this instance, expressly modified for suction, which is not the case in *Phyllostoma*. It is not unlikely that the West Indian genus *Mormoops*, of Leach, is another raptorial form.

*Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—October* 1840.

| Day. | Morning Tide A. M. | | | | | Wind. | Evening Tide P. M. | | | | | Wind. | Weather, &c. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low Water. | | High Water. | | Range of Tide. | | Low Water. | | High Water. | | Range of Tide. | | |
| | Time. | Height. | Time. | Height. | | | Time. | Height. | Time. | Height. | | | |
| 1 Thursdy. | 7 49 | 4 3 | 1 24 | 9 11 | 5 8 | S. E. .. | 8 3 | 2 1 | 1 56 | 10 9 | 8 8 | South... | 6. A. M. rather cloudy, 8 A. M. clear. |
| 2 ,, | 8 7 | 4 8 | 2 14 | 9 4 | 4 8 | S. .... | 8 12 | 2 6 | 2 15 | 10 4 | 7 10 | S S.W. | 8 43 A. M. thunder, day alternately clear and cloudy, 9 30 P. M. cloudy with appearance of rain. |
| 3 ,, | 8 16 | 5 1 | 2 25 | 9 6 | 4 5 | S.S.W. | 8 37 | 3 11 | 2 34 | 10 2 | 6 3 | S. W... | 4 20 A. M. squall from S. W., 4 38 light shower, day alternately clear and cloudy. |
| 4 Sunday, | 8 49 | 5 4 | 2 48 | 9 3 | 3 11 | S. W... | 9 2 | 5 11 | 3 2 | 9 11 | 4 0 | S.S.W. | 4 20 A. M. Do. do. 4 47 heavy showers with thunder and lightning, forenoon cloudy with light rain, noon clear. |
| 5 ,, | 9 6 | 6 2 | 3 12 | 9 1 | 2 11 | S.S.W. | 9 13 | 6 4 | 3 25 | 9 4 | 3 0 | S. W... | ——— day alternately clear and cloudy. |
| 6 ,, | 9 49 | 6 9 | 3 48 | 8 9 | 2 0 | S. W... | 11 12 | 6 7 | 4 19 | 8 11 | 2 4 | Calm... | 4 23 A. M. squall with rain, thunder, and lightning, 11 13 passing showers, noon overcast. |
| 7 ,, | 0 0 | 0 0 | 5 43 | 9 2 | 0 0 | West... | 0 17 | 7 3 | 6 49 | 9 8 | 2 5 | S.S.W. | 2 15 A. M. heavy showers with thunder and lightning, day alternately clear and cloudy. |
| 8 ,, | 1 12 | 7 4 | 7 46 | 9 9 | 2 5 | S. W... | 1 53 | 6 7 | 8 36 | 9 11 | 3 4 | S. W... | 1 45 A. M. squall with rain, thunder, and lightning, day do. do., 8 43 P. M. thunder and lightning. |
| 9 ,, | 2 14 | 5 6 | 9 15 | 10 1 | 4 7 | S. W... | 2 43 | 5 2 | 9 27 | 11 2 | 6 0 | N. .... | ——— day alternately clear and cloudy. |
| 10 ,, | 3 0 | 4 11 | 10 4 | 10 10 | 5 11 | S. W... | 3 32 | 4 7 | 10 46 | 11 6 | 6 11 | S. S. W. | Forenoon clear, noon sultry, 2 37 P. M. squall from SSW. with thunder, evening clear. |

*Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—October 1840,—(Continued.)*

| Day. | Morning Tide A. M. | | | | | Wind. | Evening Tide. P. M. | | | | | Wind. | Weather, &c. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low Water. | | High Water. | | Range of Tide. | | Low Water. | | High Water. | | Range of Tide. | | |
| | Time. | Height. | Time. | Height. | | | Time. | Height. | Time. | Height. | | | |
| 11 ○ Sunday | 4 43 | 3 9 | 11 12 | 11 4 | 7 7 | S. W... | 5 18 | 4 5 | 11 32 | 11 8 | 7 3 | S. .... | Forenoon clear, and sultry all day, 11-56 A. M. thunder. |
| 12 ,, | 5 33 | 2 11 | 11 23 | 11 6 | 8 7 | S. S. W. | 5 48 | 2 7 | 11 47 | 11 9 | 9 2 | S. W... | Forenoon clear, noon cloudy, afternoon alternately clear and cloudy. |
| 13 ,, | 6 3 | 3 9 | 0 0 | 0 0 | 0 0 | S. W... | 6 9 | 2 1 | 0 10 | 11 8 | 9 7 | S. W... | Clear all day. |
| 14 ,, | 6 18 | 3 2 | 0 17 | 11 2 | 8 0 | S. E. .. | 6 32 | 2 3 | 0 32 | 11 7 | 9 4 | S. W... | Day alternately clear and cloudy, 2. 48 P. M. thunder, 7 lightning. 6 A. M hazy, 11 30 A. M. thunder, 11 49 squally, noon light rain. |
| 15 ,, | 6 47 | 3 11 | 0 53 | 10 11 | 7 0 | S. E. .. | 6 57 | 2 5 | 0 49 | 12 3 | 9 10 | S. W... | |
| 16 ,, | 7 2 | 4 6 | 1 9 | 10 9 | 6 3 | Calm. .. | 7 12 | 2 11 | 1 15 | 11 7 | 8 8 | S. W... | Forenoon clear, noon cloudy, 1 34 P. M. squally, 2 P. M. drizzling rain, 6 52 thunder. |
| 17 ,, | 7 20 | 5 4 | 1 22 | 10 6 | 5 2 | S. E... | 7 51 | 4 10 | 1 49 | 11 2 | 6 4 | S. .... | Forenoon clear, noon cloudy, 35 P. M. thunder, 5 46 P. M. drizzling rain, 6 52 thunder. |
| 18 ☾ Sunday | 8 17 | 5 6 | 2 23 | 10 1 | 4 7 | S. W. .. | 8 49 | 5 1 | 2 37 | 10 11 | 5 10 | S. S. W. | 6 55 A. M. light rain, 8 25 thunder, day cloudy throughout. |
| 19 ,, | 9 23 | 5 4 | 3 13 | 9 10 | 4 6 | North. | 10 27 | 6 1 | 3 38 | 9 9 | 3 8 | W. .... | 2 48 A. M. thunder, 10 25 light rain, noon cloudy, afternoon rather clear. |
| 20 ,, | 10 46 | 6 2 | 5 19 | 0 0 | 3 8 | North. | 11 42 | 6 4 | 5 56 | 9 8 | 3 4 | S. W... | 7 A. M. thunder, 8 51 showers, day cloudy throughout. |
| 21 ,, | 0 0 | 0 0 | 6 27 | 9 11 | 0 0 | N. E... | 2 18 | 6 3 | 8 17 | 10 3 | 4 0 | S. W... | Day alternately clear and cloudy, 1 10 P. M. thunder. |
| 22 ,, | 2 38 | 5 10 | 8 49 | 10 2 | 4 1 | N. W. | 2 43 | 5 3 | 9 27 | 10 9 | 5 6 | S. W... | Ditto do. do., 2 4 P. M. thunder and lightning. |

*Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—October,* 1840,—*(Continued.)*

| Day. | Morning Tide A. M. | | | | | | Evening Tide P. M. | | | | | | Weather, &c. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low Water. | | High Water. | | Range of Tide. | Wind. | Low Water. | | High Water. | | Range of Tide. | Wind. | |
| | Time. | Height. | Time. | Height. | | | Time. | Height. | Time. | Height. | | | |
| 23 ,, | 3 7 | 5 6 | 9 39 | 10 7 | 5 1 | N. .... | 3 18 | 4 5 | 10 5 | 11 2 | 6 9 | N. W... | 7 A M. thunder, day alternately clear and cloudy, 11 43 A. M. passing shower, 2 3 P. M. thunder. |
| 24 ,, | 3 34 | 5 2 | 10 23 | 10 10 | 5 8 | N. .... | 4 13 | 3 11 | 10 48 | 11 4 | 7 5 | N. .... | Clear all day, 1 57 P. M. thunder and lightning, 2 48 light rain. |
| 25 ● Sunday | 4 18 | 4 10 | 11 8 | 11 1 | 6 3 | W. . | 4 27 | 3 2 | 11 38 | 11 5 | 8 3 | E. .... | Forenoon clear, afternoon cloudy, 3 57 P. M. thunder and lightning, 4 12 rain. |
| 26 ,, | 4 39 | 5 3 | 11 34 | 11 6 | 6 3 | W. .. | 4 52 | 2 11 | 11 58 | 11 4 | 8 5 | N. .... | 9 43 A. M. light rain, noon cloudy, 7 30 P. M. drizzling rain. |
| 27 ,, | 5 3 | 5 1 | 0 0 | 0 0 | 0 0 | W. .... | 5 10 | 2 3 | 0 6 | 10 11 | 8 8 | W. .... | ——— cloudy all day, 3 8 P. M. thunder, 3 25 rain. |
| 28 ,, | 5 18 | 5 7 | 0 17 | 10 9 | 5 2 | W. .... | 5 32 | 2 1 | 0 23 | 11 1 | 9 0 | South... | Ditto ditto 7 9 P. M. light rain until midnight. |
| 29 ,, | 5 45 | 5 8 | 0 38 | 10 2 | 5 6 | N. W... | 5 58 | 1 11 | 0 58 | 11 3 | 9 4 | S. W... | Ditto ditto, 10 52 A. M. light rain. |
| 30 ,, | 6 2 | 5 10 | 1 7 | 10 1 | 4 3 | N. W... | 6 7 | 2 3 | 1 8 | 10 11 | 8 8 | S. W... | 2 23 A. M. heavy showers, 0 45 P. M. thunder, day alternately clear and cloudy. |
| 31 ,, | 6 12 | 5 7 | 1 13 | 9 11 | 4 4 | N. W... | 6 23 | 4 7 | 1 20 | 10 10 | 6 3 | South... | Forenoon alternately clear and cloudy, noon dark and cloudy with thunder, 1 55 P. M. rain. |

*Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—November* 1840.

| Day. | Morning Tide A. M. | | | | | Wind | Evening Tide P. M. | | | | | Wind. | Weather, &c |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low Water. | | High Water. | | Range of Tide. | | Low Water. | | High Water. | | Range of Tide. | | |
| | Time. | Height. | Time. | Height. | | | Time. | Height. | Time. | Height. | | | |
| 1 Sunday. | 6 29 | 5 2 | 1 28 | 9 6 | 4 4 | W. .... | 6 57 | 5 4 | 1 34 | 10 7 | 5 3 | S. ... | 4 25 A. M. thunder, 35 P. M. thunder, 2 15 showers, day alternately clear and cloudy. |
| 2 ☽ | 7 8 | 5 7 | 2 7 | 9 3 | 3 8 | N. W... | 7 28 | 5 9 | 2 13 | 9 11 | 4 2 | N. .... | 6 47 A. M. light rain, 15 P. M. drizzling rain with thunder. |
| 3 ,, | 7 56 | 6 2 | 2 37 | 9 3 | 3 1 | N. .... | 8 53 | 5 11 | 2 17 | 9 2 | 3 3 | S. .... | 1 34 A. M. thunder, 1 47 passing showers, day alternately clear and cloudy. |
| 4 ,, | 9 8 | 6 3 | 3 12 | 8 9 | 2 6 | N .... | 10 53 | 6 7 | 3 52 | 8 7 | 2 0 | S. .... | Day alternately clear and cloudy. |
| 5 ,, | 11 54 | 5 8 | 6 15 | 8 8 | 3 0 | N. .... | 0 0 | 0 0 | 6 16 | 9 3 | 0 0 | S. W... | Ditto ditto, 3 20 P. M. light rain with thunder. |
| 6 ,, | 0 49 | 6 2 | 7 57 | 9 7 | 3 5 | N. .... | 1 45 | 5 3 | 8 48 | 9 10 | 4 7 | N. E... | Cloudy all day, 2 18 P. M. thunder with appearance of rain. |
| 7 ,, | 2 12 | 5 6 | 9 18 | 10 1 | 4 7 | N. ... | 2 22 | 4 7 | 9 34 | 10 4 | 5 9 | N. E... | Forenoon clear, noon overcast, 2. 24 P. M. heavy showers, 9 24 light showers. |
| 8 Sunday, | 2 32 | 5 2 | 9 47 | 10 7 | 5 5 | S. .... | 2 43 | 4 2 | 9 56 | 10 9 | 6 7 | N. W .. | Day alternately clear and cloudy, 2 10 M.P. drizzling rain. |
| 9 ○ | 2 57 | 3 11 | 10 5 | 10 11 | 7 0 | S. ... | 3 19 | 3 1 | 10 29 | 11 2 | 8 1 | N. W.. | 5 27 A. M. squall from westward with rain, day alternately clear and cloudy. |
| 10 | 3 28 | 3 7 | 10 35 | 11 5 | 7 10 | S. W... | 3 39 | 2 3 | 10 49 | 11 4 | 9 1 | N. W.. | 5 27 A. M. light rain, day overcast. |
| 11 ,, | 3 52 | 4 5 | 11 13 | 11 6 | 7 1 | S. .... | 4 17 | 1 11 | 11 23 | 11 5 | 9 6 | N. .... | 4 56 A. M. squall from westward with rain, day alternately clear and cloudy. |
| 12 ,, | 4 20 | 4 7 | 11 37 | 11 8 | 7 1 | W. .... | 4 48 | 2 3 | 11 54 | 11 2 | 8 11 | S. .... | 2 37 A. M. ditto ditto ditto ditto ditto. |
| 13 ,, | 5 47 | 4 8 | 0 0 | 0 0 | 0 0 | Calm. | 6 18 | 2 3 | 0 17 | 11 6 | 9 3 | Calm. | 11 28 A. M. A passing shower, day alternately clear and cloudy, 1 30 P. M. thunder. |

*Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—November* 1840,—*(Continued.)*

| Day. | Morning Tide A M. | | | | | Winds | Evening Tide P. M. | | | | | Wind. | Weather, &c. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low Water. | | High Water. | | Range of Tide. | | Low Water. | | High Water. | | Range of Tide. | | |
| | Time. | Height. | Time. | Height. | | | Time. | Height. | Time. | Height. | | | |
| 14 ,, | 6 49 | 4 11 | 0 28 | 10 11 | 6 0 | N. .... | 7 19 | 2 4 | 1 7 | 11 3 | 8 11 | W .... | 4 53 A. M rain, 5 10 squall from westward, 25 P. M. rain, day cloudy throughout, 6 50 P. M. light rain. |
| 15 Sunday. | 7 49 | 5 2 | 1 27 | 10 8 | 5 6 | N. W. | 8 5 | 3 2 | 1 52 | 11 1 | 7 11 | W. .... | Day alternately clear and cloudy, 5 54 P. M. light rain. |
| 16 ( | 8 19 | 5 3 | 2 12 | 10 3 | 5 0 | N. E. .. | 9 8 | 3 5 | 2 35 | 10 6 | 7 1 | S..... | Ditto ditto, 8 5 P. M. ditto. |
| 17 | 9 17 | 5 8 | 3 12 | 10 1 | 4 5 | N. ... | 10 53 | 5 3 | 3 24 | 9 3 | 4 0 | W. .... | Ditto ditto, strong westerly wind prevailing, 5 56 P. M. squall from northward with rain. |
| 18 ,, | 11 56 | 5 11 | 5 57 | 9 5 | 3 6 | N. .... | 0 0 | 0 0 | 6 47 | 9 4 | 0 0 | W. .... | 7 12 A. M. drizzling rain, 1 15 P. M. thunder, 1 43 rain, 7 32 showers, 7 45 thunder. |
| 19 ,, | 0 53 | 5 6 | 7 12 | 9 6 | 4 0 | N. .... | 1 12 | 6 2 | 7 32 | 9 8 | 3 6 | W. .... | 8 19 A. M. ditto ditto, noon rather clear, 3 5 P. M. showers. |
| 20 ,, | 1 32 | 5 9 | 7 54 | 9 11 | 4 2 | N. .... | 1 56 | 3 11 | 8 13 | 9 11 | 6 0 | N. W. | 11 33 A. M. drizzling rain, day overcast. |
| 21 ,, | 2 23 | 5 4 | 8 42 | 10 3 | 4 11 | N. .... | 2 49 | 3 5 | 9 13 | 10 2 | 6 9 | N. ..., | 10 42 A. M. ditto ditto, 1 34 P. M. rain with thunder and lightning. |
| 22 Sunday. | 3 15 | 4 7 | 9 56 | 10 11 | 6 4 | N. .... | 3 47 | 2 11 | 10 12 | 10 9 | 7 10 | N. E. .. | Forenoon alternately clear and cloudy, 0 34 P. M. heavy showers, 1 5 thunder, 6 42 light rain, 7 2 thunder. |
| 23 ,, | 4 14 | 4 5 | 10 20 | 11 2 | 6 9 | N. .... | 4 23 | 2 6 | 10 34 | 11 1 | 8 7 | N. .... | 6 52 A. M. light rain, noon cloudy, 3 32 P. M. rain. |

*Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—November* 1840.—*(Continued.)*

| Day. | Morning Tide A. M. | | | | | Winds. | Evening Tide P. M. | | | | | Winds. | Weather, &c. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low Water. | | High Water. | | Range of Tide. | | Low Water. | | High Water. | | Range of Tide. | | |
| | Time. | Height. | Time. | Height. | | | Time. | Height. | Time. | Height. | | | |
| 24 ● | 4 49 | 4 8 | 10 53 | 10 11 | 6 3 | N. E .. | 5 7 | 2 3 | 11 12 | 11 2 | 8 11 | N. .... | 10 2 A. M. light rain, noon cloudy, 3 28 P. M. rain. |
| 25 ,, | 5 13 | 1 3 | 11 18 | 10 10 | 6 7 | N. .... | 5 19 | 2 1 | 11 28 | 11 3 | 9 2 | N. .... | 7 31 A. M. light rain, day cloudy with light rain occasionally. |
| 26 ,, | 5 38 | 4 1 | 11 36 | 10 11 | 6 10 | N. W. | 5 42 | 2 6 | 11 58 | 11 4 | 8 10 | N. .... | 8 3 A. M. ditto ditto, noon cloudy, afternoon partially clear. |
| 27 ,, | 6 7 | 5 6 | 0 0 | 0 0 | 0 0 | N. .... | 6 17 | 2 9 | 0 13 | 10 11 | 8 2 | N. .... | Day alternately clear and cloudy. |
| 28 ,, | 6 42 | 5 7 | 0 28 | 11 1 | 5 1 | N. W. | 6 58 | 3 1 | 0 53 | 10 9 | 7 8 | S..... | Ditto ditto, 9 17 A. M. squall from southward with light rain. |
| 29 Sunday | 7 9 | 5 11 | 1 5 | 10 10 | 4 11 | N. .... | 7 18 | 3 4 | 1 20 | 10 6 | 7 2 | S. W... | 5 17 A. M. squall from westward, 5 32 heavy showers, day alternately clear and cloudy. |
| 30 ,, | 7 43 | 5 8 | 1 32 | 10 4 | 4 8 | N. .... | 8 6 | 3 8 | 1 56 | 10 4 | 6 8 | S. W... | 5 17 A. M. heavy showers, day alternately clear and cloudy. |

*Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—December, 1840.*

| Day. | | Morning Tide A. M. | | | | | | Evening Tide P. M. | | | | | | Weather, &c. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low Water. | | High Water. | | Range of Tide. | Wind. | Low Water. | | High Water. | | Range of Tide. | Wind. | |
| | | Time. | Height. | Time. | Height. | | | Time. | Height. | Time. | Height. | | | |
| 1 | Tuesday | 8 11 | 5 9 | 2 12 | 9 11 | 4 2 | N. .... | 8 23 | 4 2 | 2 15 | 10 2 | 6 0 | S. W... | Day alternately clear and cloudy, 1 32 P. M. thunder. |
| 2 | ☽ | 8 34 | 5 11 | 2 36 | 9 7 | 3 8 | N. .... | 8 53 | 4 4 | 2 47 | 9 6 | 5 2 | S. by N. | 11 27 A. M. showers, noon cloudy, 2 25 P.M. thunder. |
| 3 | ,, | 9 12 | 6 2 | 3 6 | 9 7 | 3 5 | N. .... | 10 27 | 5 7 | 3 19 | 8 9 | 3 2 | E. .... | 2 18 A. M. a passing shower, 2 23 P. M. rain with thunder and lightning. Day alternately clear and cloudy. |
| 4 | ,, | 10 49 | 5 9 | 4 45 | 8 7 | 2 10 | E. .... | 12 0 | 5 6 | 5 56 | 8 10 | 3 4 | N. .... | 6 A. M. clear, 11 42 light rain, noon thunder, afternoon overcast. |
| 5 | ,, | 0 0 | 0 0 | 6 27 | 9 8 | 0 0 | N. .... | 0 25 | 4 9 | 6 57 | 9 10 | 5 1 | N. .... | Day alternately clear and cloudy, 11 38 A. M. showers, 4 2 P. M. thunder. |
| 6 | Sunday | 1 4 | 5 3 | 7 25 | 10 2 | 4 11 | N. .... | 1 26 | 4 2 | 7 49 | 10 1 | 5 11 | N. .... | 7 25 A. M. light rain, noon cloudy, 1 12 P. M. heavy showers, with thunder and lightning. |
| 7 | ,, | 1 54 | 4 11 | 8 15 | 10 6 | 5 7 | E. .... | 2 7 | 3 2 | 8 36 | 10 3 | 7 1 | N. .... | 6 53 A. M. ditto, 2 26 P. M. do. do. do. do. |
| 8 | ,, | 1 32 | 4 9 | 8 49 | 10 11 | 6 2 | N. W. | 2 49 | 2 7 | 9 16 | 10 8 | 8 1 | N. .... | Day clear, 5 56 P.M. thunder & lightning. |
| 9 | ○ | 2 58 | 4 8 | 9 47 | 11 5 | 6 9 | N. W. | 3 25 | 2 4 | 9 43 | 11 3 | 8 11 | N. W... | Day alternately clear and cloudy, 4 25 thunder and lightning, 4 55 rain. |
| 10 | ,, | 3 52 | 4 3 | 10 23 | 11 10 | 7 7 | N. .... | 4 7 | 2 1 | 10 42 | 11 7 | 9 6 | N. W... | Ditto ditto, 1 28 P. M. rain, 1 56 thunder and lightning. |
| 11 | ,, | 4 59 | 3 11 | 11 19 | 11 11 | 8 0 | N. .... | 5 34 | 1 11 | 11 52 | 11 8 | 9 9 | N. W... | Ditto do., 0 35 P. M. ditto, 3 30 rain. |
| 12 | ,, | 5 54 | 4 11 | 0 0 | 0 0 | 0 0 | S. W... | 6 12 | 2 4 | 0 17 | 12 2 | 9 10 | S. W... | 5 25, A. M. light rain, 10 9 P. M. squall from westward with rain, &c. |
| 13 | Sunday | 6 53 | 5 7 | 0 28 | 11 9 | 6 2 | W. .... | 7 9 | 2 11 | 1 9 | 11 11 | 9 0 | S..... | Day alternately clear and cloudy, 7 8 P. M. squall with rain. [clear & cloudy. |
| 14 | ,, | 7 27 | 5 2 | 1 27 | 11 5 | 6 3 | N. W. | 7 49 | 3 11 | 1 43 | 11 4 | 7 5 | S. W... | ,, 9 A. M. heavy showers, day alternately |

*Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—December, 1840.—(Continued.)*

| Day. | | Morning Tide A. M. | | | | | | Evening Tide P. M. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low Water. | | High Water. | | Range of Tide. | Wind. | Low Water. | | High Water. | | Range of Tide. | Wind. | Weather, &c. | |
| | | Time. | Height. | Time. | Height. | | | Time. | Height. | Time. | Height. | | | | |
| 15 | ,, | 8 4 | 5 3 | 2 6 | 10 11 | 5 8 | N. W... | 8 29 | 6 1 | 2 23 | 10 6 | 4 5 | S..... | 9 A. M. clear all day. | |
| 16 | ☾ | 8 49 | 5 6 | 2 45 | 10 3 | 4 9 | N. .... | 9 7 | 6 2 | 2 56 | 9 5 | 3 3 | S. E. .. | ——— day overcast. | |
| 17 | ,, | 9 17 | 5 9 | 3 14 | 9 8 | 3 11 | S. W... | 10 17 | 6 3 | 3 38 | 9 3 | 3 0 | S. W. .. | ——— clear all day. | |
| 18 | ,, | 10 53 | 5 9 | 4 28 | 9 6 | 3 9 | N. .... | 11 37 | 6 4 | 5 19 | 8 5 | 2 1 | N. .... | 10 37 A. M. showers, noon thunder, afternoon overcast. | |
| 19 | ,, | 11 58 | 5 6 | 5 57 | 9 8 | 4 2 | N. .... | 0 0 | 0 0 | 6 15 | 8 4 | 0 0 | S. W. .. | 11 43 A. M. ditto, 30. P. M. ditto, day clear, and cloudy alternately. | |
| 20 | ,, | 0 16 | 5 7 | 6 31 | 9 8 | 4 1 | N. W... | 0 47 | 5 4 | 7 24 | 8 9 | 3 5 | N. W... | 11 15 A. M. thunder 23 P. M. ditto do. | |
| 21 | ,, | 1 12 | 5 7 | 7 37 | 10 2 | 4 7 | N. .... | 1 53 | 4 6 | 8 24 | 9 7 | 5 1 | S. W. .. | 10 42 A. M. rain, 2. 20 P. M. thunder do. do. | |
| 22 | ,, | 2 11 | 5 4 | 8 32 | 10 7 | 5 3 | S ..... | 2 43 | 4 2 | 8 57 | 10 1 | 5 10 | S. W. .. | 6 2 A. M. rain, noon overcast 6 7 P. M. rain. | |
| 23 | ,, | 2 57 | 5 2 | 9 5 | 10 4 | 5 2 | N. .... | 3 14 | 3 7 | 9 37 | 10 3 | 6 8 | N. .... | Day cloudy throughout, 3 32 P. M. showers. | |
| 24 | ● | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | ..... | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | ..... | ——— | |
| 25 | ,, | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | ..... | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | ..... | ——— } No observation in consequence | |
| 26 | ,, | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | ..... | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | ..... | ——— } of the buoy of the tide-guage be- | |
| 27 | Sunday | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | ..... | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | ..... | ——— } ing worn out by friction. | |
| 28 | ,, | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | ..... | 7 57 | 3 2 | 0 0 | 0 0 | 0 0 | N. E. .. | Day alternately clear and cloudy. | |
| 29 | ,, | 8 11 | 4 11 | 2 11 | 10 2 | 5 3 | N. E. .. | 8 17 | 4 2 | 2 18 | 10 9 | 6 7 | S. E. .. | Ditto ditto ditto, 11 45 A. M. light rain, 6 17 P. M. showers, 6 17 P. M. showers. | |
| 30 | ,, | 8 28 | 5 6 | 2 27 | 9 11 | 4 5 | N. .... | 8 47 | 4 6 | 2 35 | 10 7 | 6 1 | S. E. .. | Ditto ditto ditto, 1 15 P. M. light passing showers, 3 30 P. M. thunder with frequent showers. | |
| 31 | ,, | 8 56 | 5 9 | 2 57 | 9 8 | 3 11 | N. .... | 9 7 | 4 9 | 3 12 | 10 6 | 5 7 | E. .... | ——— ditto ditto ditto, 1 37 P. M. rain. | |

(Signed,) Wm. SCOTT,
*Asst. Master Attendant.*

## *Proceedings of the Asiatic Society.*

(*Friday Evening, 4th March,* 1842.)

The Hon'ble the President in the Chair.

The following Books were presented :—

*Books received for the Meeting, on the 4th March,* 1842.

The Calcutta Christian Observer, new series, vol. 3d, No. 27, March, 1842, .. P
The Oriental Christian Spectator, 2d series, vol. 2d, No. 12th, Dec. 1841, and vol. 3rd, No. 1st, January 1842, .... .... .... .... .... P
Yarrell's History of British Birds, part 27, London, October, 1841, .... .... P
The Annals and Magazine of Natural History, vol. 7th, No. 47, and vol. 8th, No. 49, September and October, 1841, London, .... .... .... P
London, Edinburgh, and Dublin Philosopical Magazine and Journal of Science, 3rd series, vol. 19th, Nos. 123-124, September, and October, 1841, London, .... .... .... .... .... .... .... .... P
Memoir of the Royal Astronomical Society of London, 1840, vol. 11th, .... 1
Journal des Savants, Juin à Juillet, 1841, Paris, .... .... .... 2
Proceedings of the Geological Society of London, vol. 3rd, part 2nd, No. 76, 1841, .... .... .... .... .... .... .... .... P
Sykes's Notes on the Religious, Moral, and Political State of India, London, 1841, .... .... .... .... .... .... .... .... 1
Sykes's Fishes of the Dukhun, .... .... .... .... .... 1
The Calcutta Literary Gleaner, vol. 1st, No. 1. .... .... .... .... P
McCosh's Medical Advice to the Indian Stranger, London, 1841, .... .... 1

Three Volumes of Dewan and Masnevi, by Hakeem Rookeen-Uddeen of Kashaud, in good preservation, perfect, MSS. complete and well written, were offered for sale. Referred to the Committee of Papers.

The following letter from Mr. Csoma De Koros was read. The account referred to, accompanied it :—

To H. Torrens, Esq.

*Secretary to the Asiatic Society of Bengal, &c.*

Sir,—Since I am about to leave Calcutta, for a certain period, to make a tour in Central Asia, if possible, I beg you will receive and keep this memorandum, after you have communicated it with the Asiatic Society.

I respectfully acknowledge, that I have received many benefits from the Asiatic Society, although I have declined always to accept the allowance of fifty rupees, which they generously granted me in 1829, 1831, and 1841; since the Government's allowance to me, during several years, was sufficient for my support.

I intend to return again to Calcutta, and to acquaint the Society with the results of my travels. But, in case of my death on my intended journey; since I sincerely wish the prosperity, and pray for the long continuance of this noble establishment, I beg to leave my Government Securities, as also the Books and other things now taken with me, at the disposal of the Asiatic Society, delivering herewith to you my last

account of the 31st of January 1842, with the Government Agent, who is my attorney; and with whom the Promissory Notes are kept, and who will favour me, once a year, with the interest on those papers.

Since I purposely decline every correspondence with those in Europe, I beg you will kindly excuse me, if any letter or packet should be sent to me, do with it as you think best.

I remain with much respect,
Sir,
Your most obedient Servant,
A. Csoma De Koros.

*Calcutta, 9th February*, 1842.

The Secretary was requested to reply to Mr. Csoma, expressing the Society's willingness to accept the *Trusteeship* of his funds for his benefit, its earnest desire to forward his views in India in every possible way, and to render him any assistance; as well as its willingness to receive any further directions as to his funds; and its best wisbes for his welfare and safe return from bis enterprising expedition into Bootan and Tartary. It was also determined, that a copy of Mr. Csoma's letter should be transmitted to the Government Agent.

The following letter from Professor Wilson was also read:—

*East India House*, 30*th October*, 1841.

My dear Sir,—In a short letter I sent you by Mr. Coles, I informed you, that the copies of the Travels of Messrs. Moorcroft and Trebeck, which had been distributed here, were distributed in the name of the Society, and that any Societies not included in the list to which the Asiatic Society might wish to extend the presentation copies, might probably be supplied with them from those I had retained. They cannot be many. The book is not of much interest to Oriental scholars, and there are not many individuals or Societies in communication with the Asiatic Society engaged in other than Oriental literary inquiries. The chief purpose of my addressing you at present, however, is to ascertain the possibility of procuring subscriptions through the Society for a work I have just published. Ariana Antiqua, an account of the Coins and Antiquities of Afghanistan; it is a description in fact of Mr. Masson's Collections, and of some others at the India House. It is a goodly quarto volume of some 400 pages, and is intended to be a resumé of all that has been written on the Bactrian Topes and Coins. The text is illustrated by engravings of sundry Antiquities, of all the Topes opened by Mr. Masson, and of many hundred Coins from those of Euthydemus to those of the first Mahommedan invaders of India. The expence of the book has been liberally defrayed by the Court of Directors, who take part of the edition, out of which they will send a few copies to Bengal, from whence the Society will no doubt be supplied. The remaining portion, 300 copies, the Court has presented to Mr. Masson's mother, and it is for her benefit that the subscription is proposed. The price in England is 2 Guineas—allowing for expences, &c. the Indian subscription rate should be I imagine 25 Rupees. If you can procure any name from amongst those interested in Mr. Masson and his pursuits, and will send them to me with information how the subscription is to be realised, (or perhaps it would be advisable to deposit the amount with some agency house,) I will take care that all such copies as may be procurable shall be forwarded. Mr.

Lewis (Masson) has some of the copies subscribed for here, and expects some from Bombay, so that there will not be many left for Bengal.

Yours very truly,
H. H. Wilson.

## ARIANA ANTIQUA,

*Just published by Professor* Wilson.

An account of the Coins and Antiquities of Affghanistan, being a description of Mr. Masson's Collections, and others at the India House, in one vol. quarto, pages about 400. The text illustrated by engravings of sundry Antiquities from all the Topes opened by Mr. Masson, and of many hundred Coins, from those of Euthydemus to the first Mahommedan invaders of India.

A few copies can be yet subscribed for in India, and the Secretary of the Asiatic Society will be glad to register names, with references for payment in India or England. Indian Subscription rate about 25 Rupees.

It was determined, that the work should be advertised in the Journal, and the Society should there state its readiness to become Agents for those who might desire to subscribe for it.

A second letter from Professor Wilson of 1st November 1841, referring to the incomplete numbers of volumes of the Mahabarat was read, and referred to the Librarian and Accountant to report upon.

The Annual Statement of the accounts of the Society's Booksellers, Messrs. W. H. Allen and Co. was also read, and with its enclosures referred to the Librarian and Accountant.

Read a note from J. W. Roberts, Esq. forwarding a highly interesting account of the eruption of the Volcano of Kilauca, (Sandwich Islands,) published in the Boston Baptist Missionary Magazine for August 1841.

Read a letter from Lieut. Tickell, Kolehan, to the Curator, advising the dispatch of the skins of a Gaur and a Saumer, prepared for the purpose of setting up in the Museum. A paper of measurement of the Gaur accompanied this letter, which will appear in the Journal.

The recovery of Capt. Herbert's valuable Catalogue of the Himalayan Geological Specimens, collected during his survey, was announced to the Society. These valuable MSS. which had been the objects of most anxious search on the part of the Secretary and the Acting Curator, Mr. Piddinton, and of which almost all hope had been abandoned, were fortunately traced, through the assistance of Mr. Wilkin, late Mining Assistant in Kemaon, to that district, where they were found to be in the hands of J. H. Batten, Esq. C. S. Assistant Commissioner, Kemaon, from whom a letter was read, stating, that they would be shortly sent down upon his return from a tour of duty in the district.

Read a letter of the 24th February last, from Major Thos. Wilkinson, Resident of Nagpore, announcing the dispatch from Nagpore of a facsimile of an Inscription,

from a large stone found at the village of Aurung in Chutteesgurh, about 200 miles east of Nagpoor, to which place, however, the stone had been brought by him.

The Inscription has since been read; it is without date, but Boodhist, and of about A. D. 850. The following is an abstract of it :—

*Abstract.*

"There was a Raja named *Surya Ghose*, who on the sudden death of his infant son, being overwhelmed with grief, and conscious of the instability of the wordly pursuits, caused a magnificent building to be erected for the refuge of *Moonees*, (Ascetics). After a long series of years, he had another son, who was afterwards publicly known by the celebrated name of *Udayana*.

"*Udayana* had four sons, among whom *Bhabadeva* was the youngest. His son was *Ranakeshárá*, who was the last Raja of that line. He repaired the palace of the *Moonees*, which had once been erected by his great-grandfather, and injured by time. Further, he caused many gardens, tanks, wells, and many charity houses to be made throughout."

Read a letter of Mr. Stefano Morricand, Administrateur du Museé Académique à Geneve, addressed to the late Mr. Benson, C. S. proposing to exchange specimens of Shells with him. This letter was transmitted to the Society by Dr. Wise, B. M. S.; but it was thought right that it should be referred in the first instance to Mr. Benson's executors.

La Commission de la Bibliothym de la Ville de Berne, acknowledged the receipt of the 18th volume of the Society's Transactions through their President, M. Chas. Teerledir.

Read a letter from G. A. Bushby, Esq. Secretary to Government, General Department, transmitting copy of a letter from the Military Board, with copy of one from Capt. Tremenheere, and a box containing specimens of Magnetic Iron Ore, Sulphuret of Antimony, and of Mergui Coal.

Read a letter from Lieut. H. K. Sayers, S. P. H. M. 31st Regt. offering for the Journal of the Society, Recollections of a Visit to Madura, the capital of the Bullom Country, Western Africa.

For the Contributions and Presentations, thanks were accorded.

# ADVERTISEMENT.

The "Palæologica" I published in the year 1832, as well as my work on fossil bones of the country of Georgensgmünd (1834) and my palæontological treatises contained in the Transactions of Academies and various Natural Societies, were so favourably received, that since some years I have been honoured with specimens of similar fossil organic remains of a former world, which on examination, offered important matter for results about fossil bones of the Mammalia, Reptiles, and Birds. Whilst these rare treasures were imparted to me by public and private collections of Germany, Switzerland, and the adjacent countries, with a readiness deserving every encomium, I am requested from different parts, not to publish my inquiries separately, but in a particular work. In order to satisfy such unbounded confidence and kind desire, I am willing to advance a work under the above title referring to the Fauna of a primitive world, which will contain my inquiries about fossil bones. As it is impossible to give a complete insight with this advertisement, it will suffice, to form a judgment of its worth, by citing, that this work, among the rest, will treat—of fossil bones of Pachydermata (Mastodon, Rhinoceros, Palæotherium, Dinotherium, Tapir, Microtherium, &c.), Ruminantia (Palæomeryx, Orygotherium, &c.), Rodentia (Lagomys Oeningensis), Carnivora (Harpagodon, Pachyodon, &c.), Tortoises, Sauriens, Frogs, and Birds, which have been found in beds of Lignite or Brown-coal in Switzerland and in other deposits of Molasse in this country, as well as in the pits of pisiforme Iron ore or Möskirch, in the calcareous marl near Oeningen, the gypsum near Hohenhoven, in the strata near Weisenau, and in other tertiary strata; of the skeleton parts of the marine Mammalia, called by me Halianassa, which very well designates the upper tertiary formations of our part of the world; of remains of Sauriens, Tortoises, and Birds from the cretaceous group (in the canton of Glaris, &c.); of the Plateosaurus from the Keuper; of the teeth of the Ischyrodon; of Sauriens and Tortoises from the famous formation of the lithographic limestone of Solenhofen; by the co-operation of the President Baron Andrian and the Count Münster, of the re-

markable Sauriens of Muschelkalk (Nothosaurus, Pistosaurus, Charitosaurus, &c.); and of the other fossil vertebrated animals.

As to the present eager pursuit of historical investigations about the constitution of the earth and the development of its organic types of animal life, there can be no better evidence than the remains of animals in the crust of the earth, amongst which the vertebrated animals are no doubt of the greatest importance. Thus if we add the creatures produced by the earth in a primitive age to the number at present only, we are able to estimate the riches of the whole creation, and to explain the alternations resulting from the sublime laws of nature. I am confident, therefore, that the publication of a work like this, containing anatomical and geological discoveries of a former world, will be readily promoted.

The work will appear in several numbers, the price of which shall be calculated, as is customary with such works, after the number of sheets in German, printed in Latin letters in gr. 4°, and according to the number of tables in fol°. with plates after my own drawings, or executed after my immediate direction. As gain is not the object of this publication, the lowest price cannot be determined before I know the number of subscribers; the number of copies will not exceed much the number required, and the price in every case, will not be higher than that of similar works. The subscribers will please to send their direction to the author by the post, or by well known libraries, but plainly written. The list of subscribers will be joined to the work.

Herman von Meyer.